# WIRE AND WIRE PRODUCTS

JANUARY 1944

DELIVERING
PEAK PRODUCTION—
PARAMOUNT TODAY!

READY FOR TOMORROW'S
COST-CONSCIOUS COMPETITION

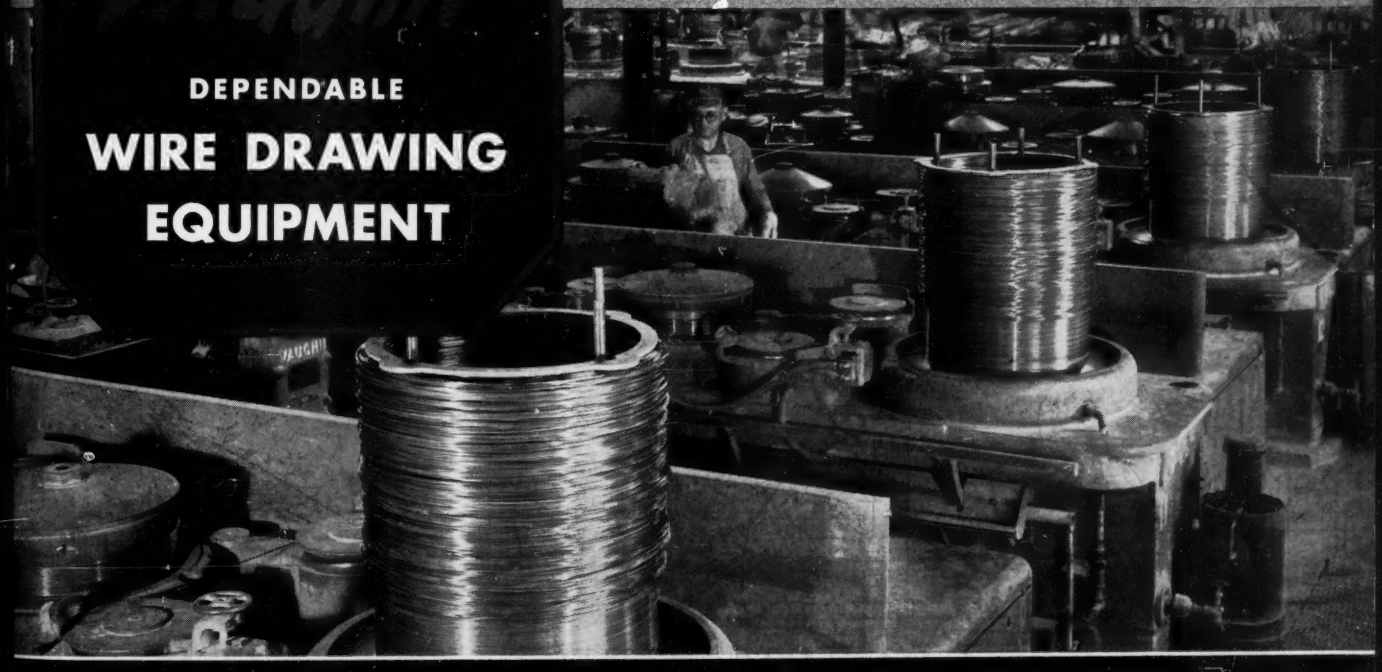
Controlled speed, flexibility, safety . . . features of Vaughn Motobloc (single or double-deck), and Vaughn Motoblox non-slip continuous machines . . . breaking records in war production, and ready to build better business in the peace to come.

THE VAUGHN MACHINERY COMPANY, CUYAHOGA FALLS, OHI

COMPLETE COLD DRAWING EQUIPMENT
Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

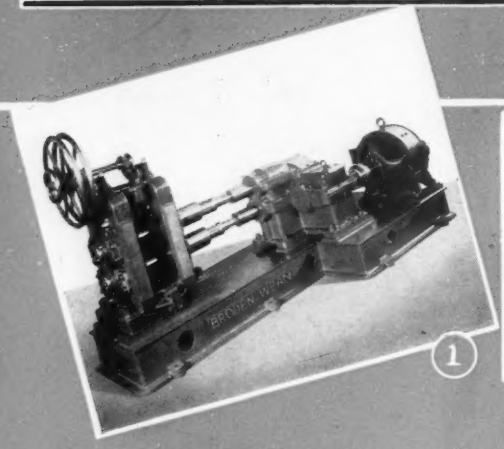
VAUGHN

DEPENDABLE
WIRE DRAWING
EQUIPMENT



OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

# WEAN-BRODEN

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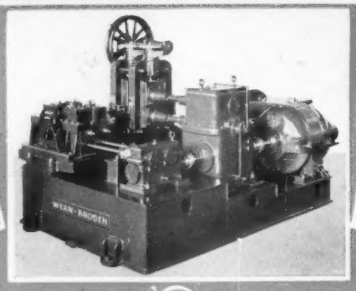


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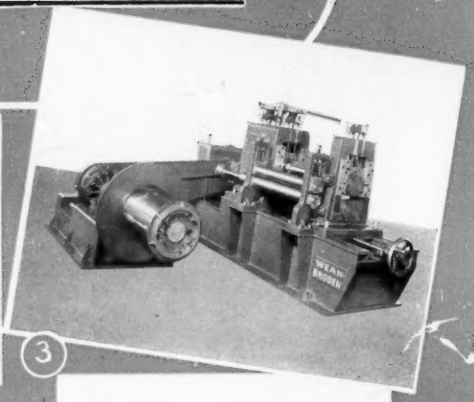


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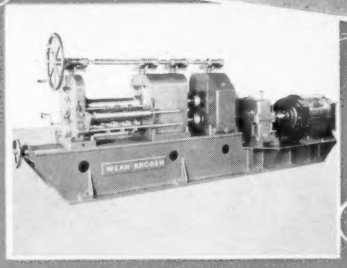



4

THE Wean Engineering Company, Inc., have long been recognized as Specialists in sheet, strip and tin mill equipment. . . . The Broden Construction Company specializes in the manufacture of narrow strip and wire mill equipment.

With the extended facilities of The Broden Construction Company as a subsidiary of The Wean Engineering Company, Inc., it is now possible to serve the steel industry more effectively.

1. Small Cold Rolling Strip Mill
2. Special Strip Cold Rolling Mill
3. Strip Reel and Slitting Unit
4. Heavy Duty Slitter
5. Special Alloy Single Draft Heavy Duty Vertical Wire Drawing Block for ⅝" Round Rod

## COLD ROLLING MACHINERY

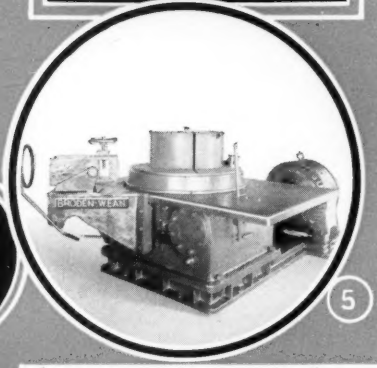
**For 36" Wide Material and Narrower**

Mills • Reels • Slitters • Levelers • Coilers • Edgers
Scale Breakers • Shears • Scrap Ballers
Continuous Pickling

## WIRE MILL EQUIPMENT

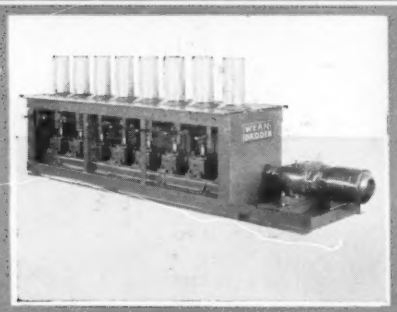
Wire Drawing Machines • Patenting • Galvanizing and Tinning Take-Up Frames • Wire Flattening • Spoolers
Nail Galvanizing and Blueing

**HOLMQUIST BARBED WIRE and WIRE FENCE MACHINERY**

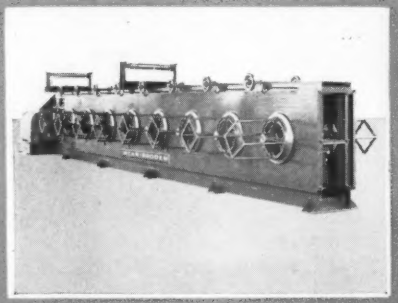



5

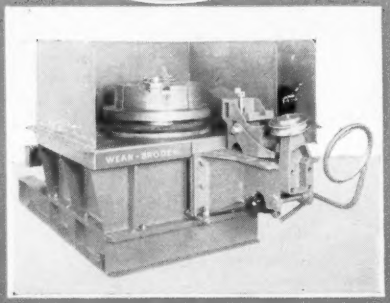
**The BRODEN CONSTRUCTION Co., Inc., Cleveland, O.**
A SUBSIDIARY COMPANY OF
**The WEAN ENGINEERING Co., Inc., Warren, O.**



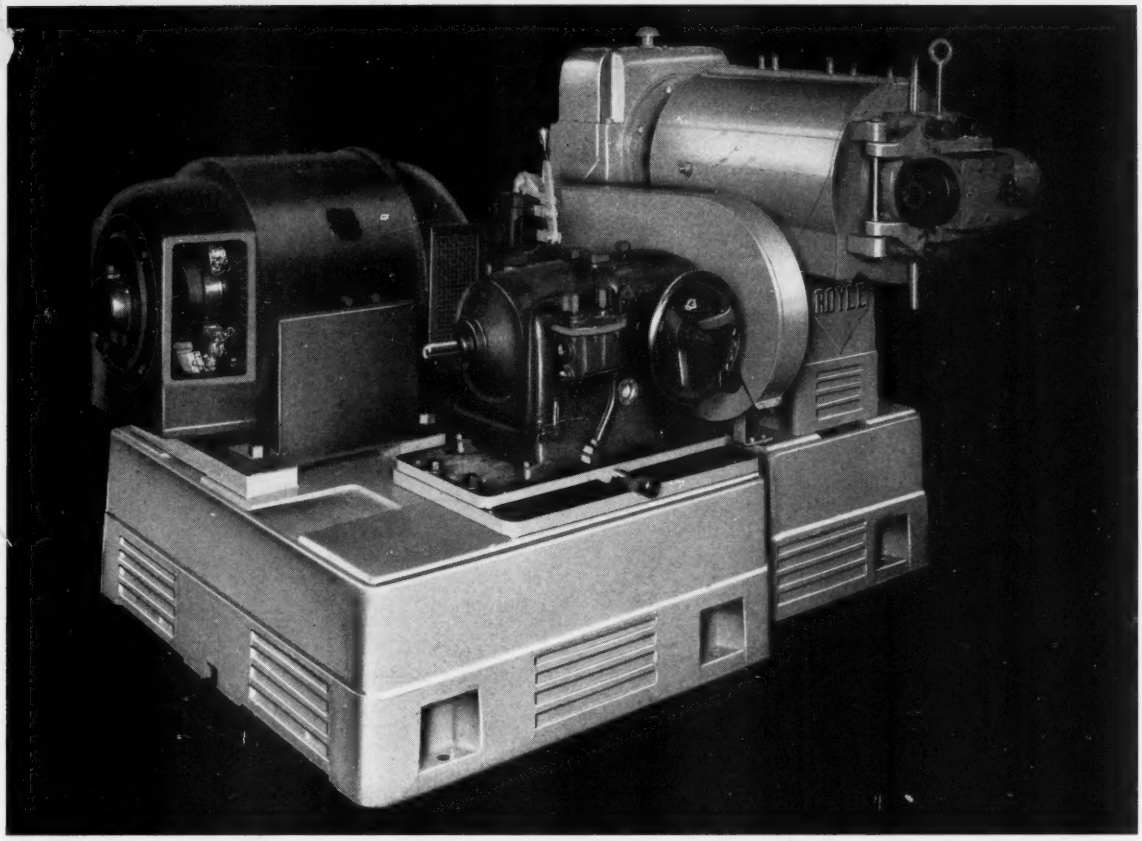

FINE WIRE TINNING UNIT




MULTIPLE WIRE TAKEUP FRAME




TWO DRAFT CONTINUOUS WIRE DRAWING MACHINE




# COMMUNICATIONS HOLD THE OFFENSIVE TOGETHER . . . .

Troops concentrated . . . supplies brought up . . . the zero hour approaches. The signal is given and the carefully planned offensive is under way.

Whether it is storming a height, establishing a beach head or a tank assault the success of the operation may well depend upon the maintenance of communications. And communications depend upon wire.

Today Royle equipment is playing an important part in meeting the demands for insulated wire that can "take it" . . . whether the icy blasts of the frozen north or the sweltering, sticky heat of the tropics.

ARMY E NAVY

**JOHN ROYLE & SONS**

ROYLE PATERSON N. J.

*PIONEER BUILDERS OF EXTRUSION MACHINES SINCE 1880*

**PATERSON 3, NEW JERSEY**

*Continental Europe*
JAMES DAY (MACHINERY) LTD.
LONDON, ENGLAND

*Home Office*
B. H. DAVIS J. W. VanRIPER
*Sherwood 2-8262*

AKRON, OHIO
J. C. CLINEFELTER
*University 3726*

# Information for combat

Minute by minute, all along the front, urgent information is fed to our fighting men over field telephone wires. Where is the enemy? How strong is he? What's he up to? These and dozens of other vital questions must be answered promptly and correctly if our men are to make the best use of their forces and equipment.

One of Bethlehem's major war jobs is supplying process wire for production of field telephone wire for the fighting fronts. This wire is bethanized (electrolytically zinc-coated) to guard it against corrosion . . . tough, because it must withstand rough-and-tumble treatment in the field . . . and very high in strength, for it is thrown into ditches, dragged through fields, woods and over rocks.

Bethlehem wire mills are turning out stock for field telephone wire in large tonnages—and dozens of other kinds of wire and products made from wire, for the battle areas and essential uses on the war production front at home.

★ ★ BETHLEHEM STEEL B E T H L E H E M W I R E

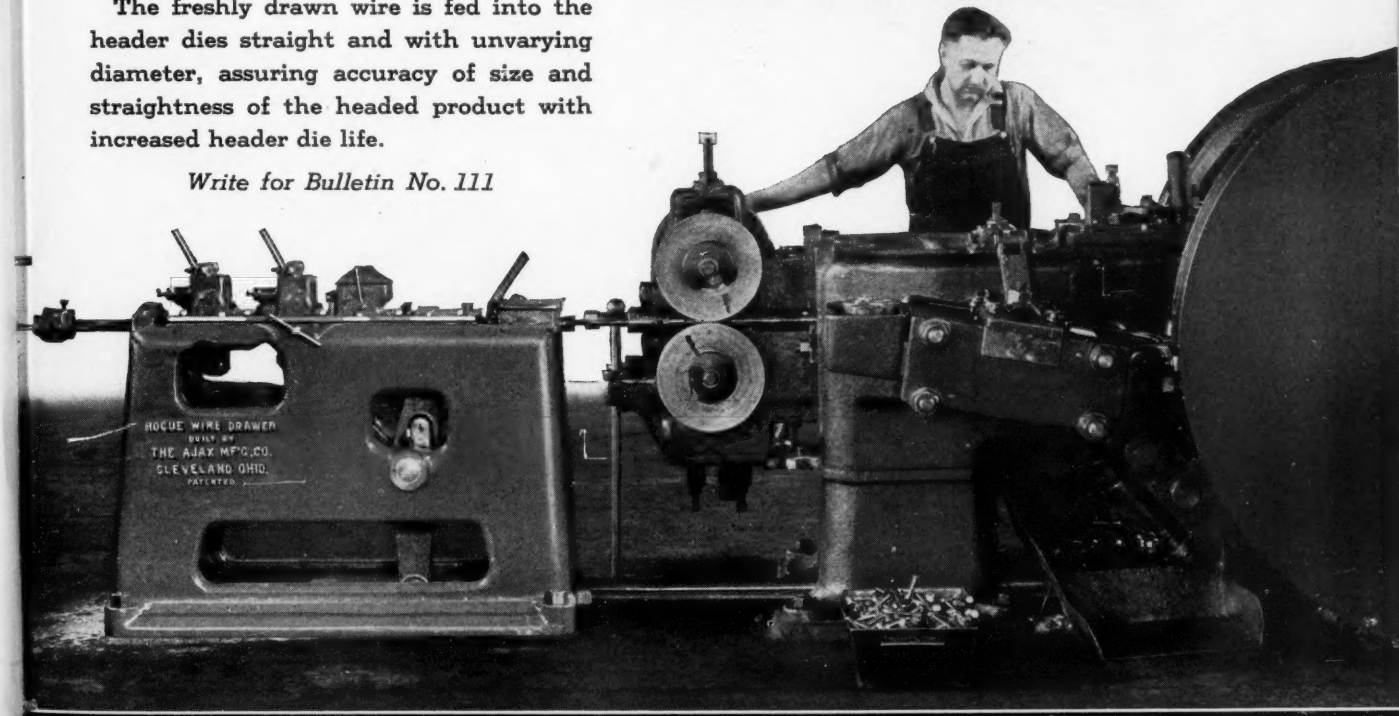
# *AJAX-HOGUE* Wire Drawers produce close tolerances on *AIRCRAFT* Screws and Bolts

**AJAX-HOGUE Wire Drawers are built in five sizes with capacity from ¼ inch to ¾ inch diameter.**

**The AJAX-HOGUE Wire Drawer used in conjunction with any modern cold heading machine makes it possible to produce cold-headed aircraft screws and bolts to aircraft tolerances.**

**The freshly drawn wire is fed into the header dies straight and with unvarying diameter, assuring accuracy of size and straightness of the headed product with increased header die life.**

*Write for Bulletin No. 111*




THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND, OHIO

621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

# STEEL spearhead of invasion

COPYRIGHT 1943—JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

A knight in armor has for centuries been the symbol of a man well armed for war. Yet, for all his heavy gear, medieval smiths had to forge for him and his horse only 150 pounds of metal.

★ ★ ★

For every one of our modern knights now in this mechanized war . . . for each soldier, sailor, marine . . . the steel industry this year produced 18,000 pounds of steel. These 18,000 pounds of steel for each fighting man go to war with him as steel in ships, tanks, planes; steel in guns, shells, bombs; steel in protective armor, medical supplies and for the safe preservation and transportation of food. To land a single fighting man on an invasion front and support him there takes enough steel in a year to make automobiles and household appliances for a number of families . . . steel that all of us gladly do without so that every son and brother may be fully armed . . . and protected.

★ ★ ★

Such is the contrast between the wars of knights and this war of the world and between the worker in metal in the middle ages and the man of steel in this modern era.

★ ★ ★

Yet war . . . the waging of war . . . the making of the weapons to arm . . . invade . . . carry the battle to centers of enemy resistance by land, sea, and air . . . is still a man-for-man job . . . with the individual initiative, enterprise, and zeal of each fighter . . . each worker . . . joined to his fellows and coordinated to the common purpose and goal. So it is that free men work and fight.

★ ★ ★

So it is that hundreds of thousands of men of steel by their skill . . . experience . . . will to do . . . and with the means that far-sighted planning and organization provide . . . wrest the raw materials from the earth and convert them into the fighting steels that are the spearhead of invasion . . . the tools with which to forge the victory.

★ ★ ★

So it is that steel will be the spearhead of peace . . . when this strongest and most serviceable of our metals will be the means of rehabilitating and restoring civilization to a world that yearns to hear the bells of freedom ring again.

**JONES & LAUGHLIN STEEL CORPORATION**

PITTSBURGH, PENNSYLVANIA

J&L STEEL

CONTROLLED QUALITY STEEL FOR WAR

*Industrial scrap helps win the war... keep your scrap moving to the steel mills.*

# 14 POINT PROGRAM

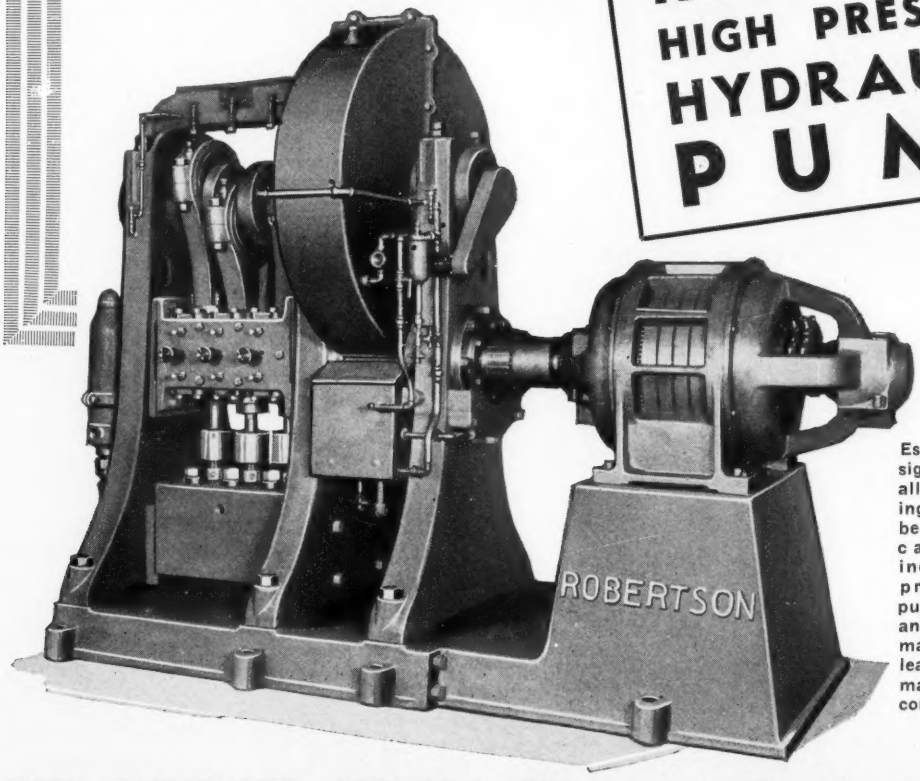
## FOR BETTER, LONGER SERVICE

1. Sight gauge showing the flow of oil which is delivered into gear case.
2. Oil filter for filtering oil from oil feed pump.
3. Oil feed pump for gear-drive and all shaft bearings.
4. Timken roller bearings on pinion shaft.
5. Flexible coupling connecting pump and motor.
6. Oil storage tank of large capacity with pump feed to eccentric and main shaft bearings.
7. Bronze bonnets on pump chamber—they will not rust.
8. Solid forged steel pump block with removable bronze valve seats.
9. Deep packing chamber to insure long life of hydraulic packings—easy to get at.
10. Spring-balanced hydraulic safety relief valve of sufficient capacity to take the full capacity of pump without undue increase in pressure.
11. Non-rust steel plungers, ground and polished.
12. Eccentric shaft of steel forging with all bearings bronze-lined.
13. Sight feed oilers for all eccentric and main shaft bearings.
14. Herringbone gear-drive in cast iron oil tight case.

All these advantages of a better product are yours on buying Robertson Equipment. You'll find pump troubles reduced by sound, solid engineering that is calculated to give you more efficiency per dollar unit than ever before.

For details of construction and operation of Robertson Pumps,—write us on your letterhead NOW. There is no obligation.

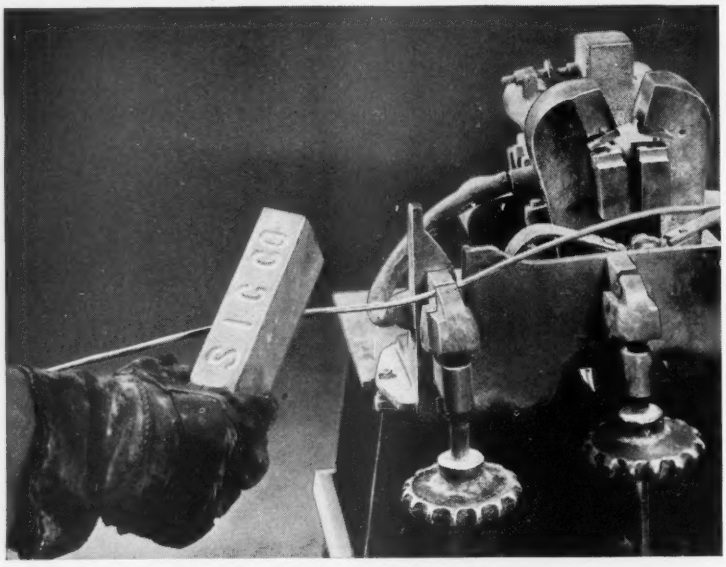
**ROBERTSON HIGH PRESSURE HYDRAULIC PUMP**




Established 1858 • Designers and builders of all types of lead encasing machinery for rubber hose and electrical cable manufacturers; including extrusion presses, hydraulic pumps, melting furnaces and pots, hydro-pneumatic accumulators, lead sheath stripping machines and dies and cores.

**JOHN ROBERTSON COMPANY, INC.** 125-137 Water St., Brooklyn ;, New York

Standardize with Standard




Standardize with Standard

Welding of Spliced Wire With Cake of SIC CO WELDCOTE

# WELDCOTE

**USES:** . . . . . For application to all welds on stock, either rod or wire.

**FINISH:** . . . . . All finishes.

**CHARACTERISTICS:** Has melting point adjusted so that bar should be rubbed all along weld while hot. This keeps scale from forming, which ordinarily occurs on the hot metal surface surrounding the weld.

The WELDCOTE bar forms a lubricant coating on each side and over the weld, also coats the metal with a pigment to serve as a carrier for the regular lubricant. This combination of lubricant and pigment prevents cutting and scratching on the die which occurs on untreated welds, because the heat involved in the welding operation causes scale, and the subsequent grinding of the burr leaves raw, uncoated metal, which can neither pull in lubricant, nor present a smooth surface to the surface of the die.

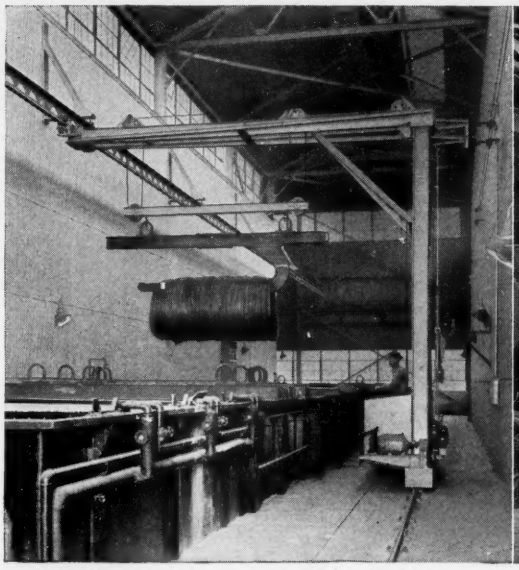
**SHIPPING UNIT:** . . 275-300 Pound Barrel.

***Complete listing of our products contained in our catalogue, "WIRE & WIRE DRAWING—IN WORLD PROGRESS" will be sent on request. Address:***

STANDARD INDUSTRIAL COMPOUNDS CO.

4600 W. FERDINAND ST.

CHICAGO 44, ILLINOIS



*The Cleveland Tramrail single-leg gantry crane makes possible the cleaning of rod on a straight-line production basis. One man handles all cleaning operations with this equipment.*

*The handling of wire in this new nail department is made fast and efficient with Cleveland Tramrail Cranes. The carriers are provided with rigid arms for easy maneuvering.*

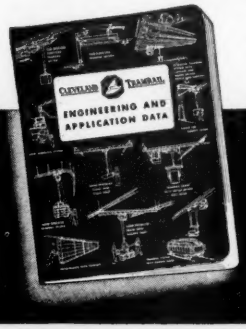
# MODERN HANDLING EQUIPMENT BOOSTS PRODUCTION AT COLUMBIA STEEL CO., PITTSBURG, CALIFORNIA

AFTER a thorough study of the possibilities of straight-line production methods in the cleaning house, for the cleaning of rod and wire, The Columbia Steel Co., decided that with the many obvious advantages of the straight-line method, it would be a logical step in their continuous program of modernization to discard their old cleaning house and build a new one.

The new cleaning house has been completed, and as is evident from the photograph, it is a clean, orderly room, quite unlike old-type cleaning houses. The most important factor in making this new cleaning house possible is the development of the Cleveland Tramrail single-leg gantry cleaning house crane. This enables the handling of rod and wire through the various cleaning operations on a straight-line production basis. As a result, production is boosted, costs sharply cut and health and safety conditions improved.

Likewise, in the Wire Drawing and Nail Departments, Cleveland Tramrail equipment has been installed and is of great help in maintaining production at a high level.

If you work with rod or wire, it will be to your advantage to discuss the many possibilities of Cleveland Tramrail with your local representative.

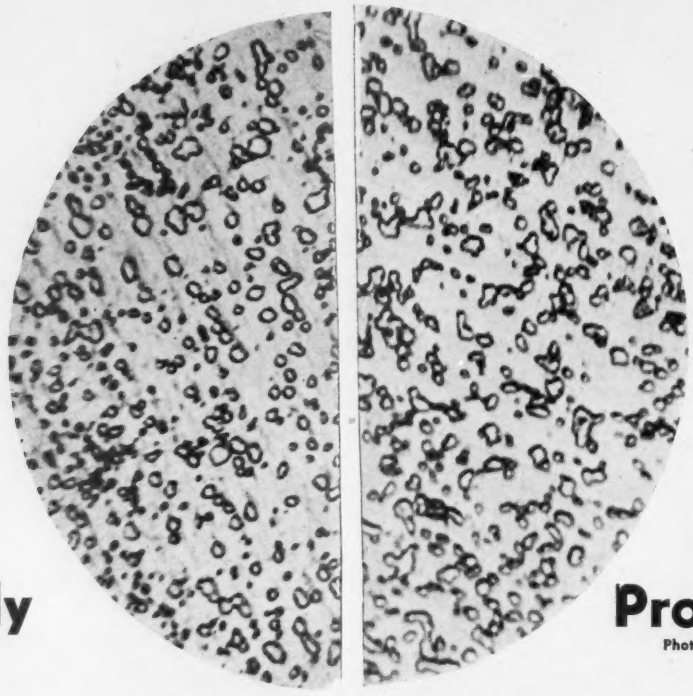



*GET THIS BOOK!*
BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

**CLEVELAND TRAMRAIL DIVISION**
THE CLEVELAND CRANE & ENGINEERING CO.
1141 EAST 283RD ST. WICKLIFFE, OHIO.

**CLEVELAND TRAMRAIL**
**OVERHEAD MATERIALS HANDLING EQUIPMENT**

# CONVENTIONAL SPHEROIDIZING V.S. NEW HOLDEN METHOD



**Slow Costly**

**Speedy Profits**

Photomicrographs 1500X

## SAE 1060 Steel

| | |
|---|---|
| *Left Half:* SPHEROIDIZED in Conventional Bell-Type Controlled Atmosphere Furnaces. | *Right Half:* SPHEROIDIZED by New Holden Method in Neutral Baths. Continuous Operation. |
| TIME: Heating, Soaking and Cooling totals 72 Hours. | TIME: Complete Cycle Not Over 3 Hours. No Decarburization. |
| CONVENTIONAL METHOD is slow, due to the variation in the rate of heat penetration from the outside to the center of the coils. | NEW HOLDEN Method permits fast heating to temperature — without scale — one or 20 strips arriving at temperature at the same time. |

*Information available to executives who will execute an Agreement of non-disclosure of technical details of the process*

**THE A. F. HOLDEN COMPANY** *Metallurgical*

***Manufacturers of Heat Treating Baths and Fuel-Fired and***

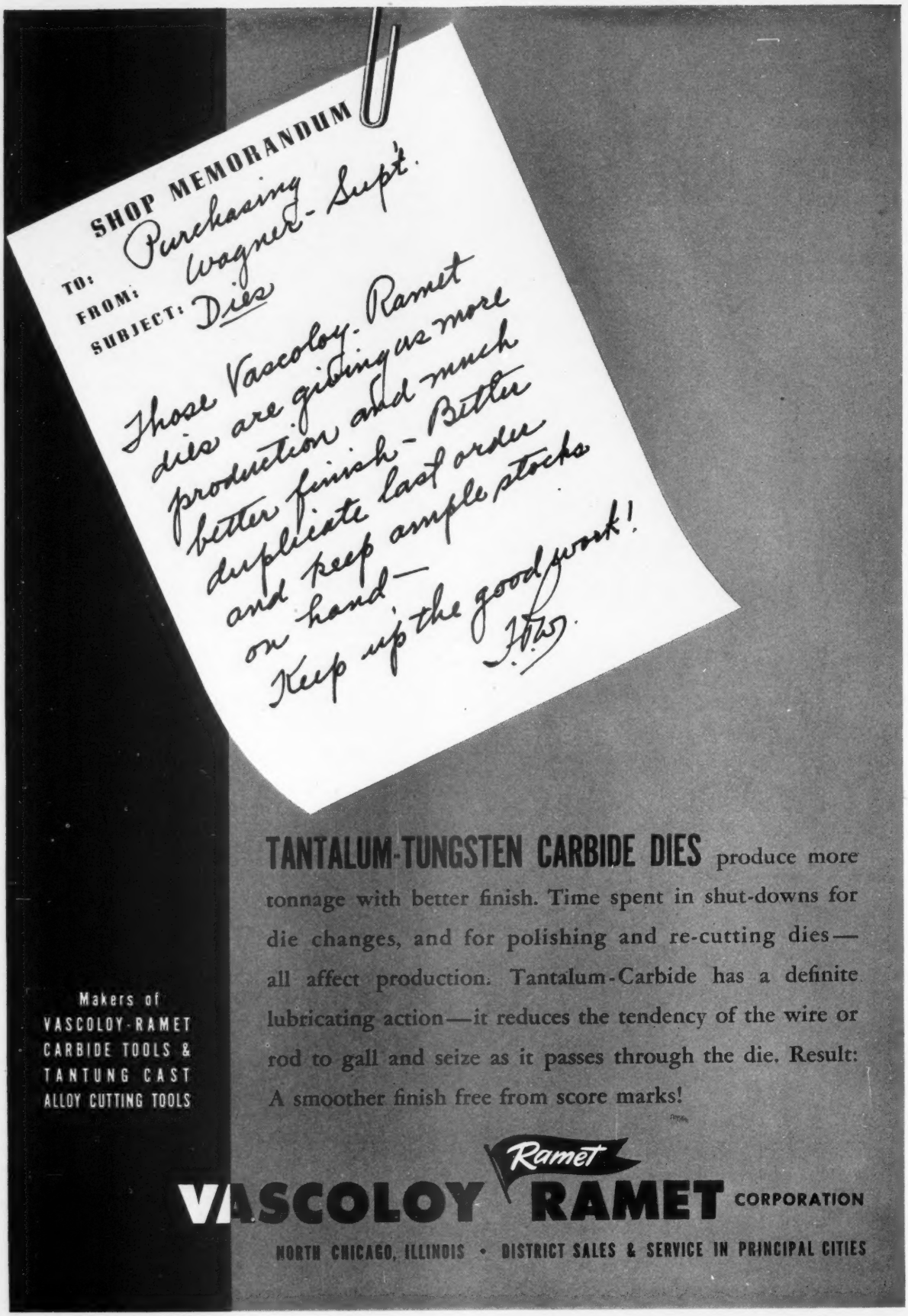
**CANADIAN LICENSEE: PEACOCK**

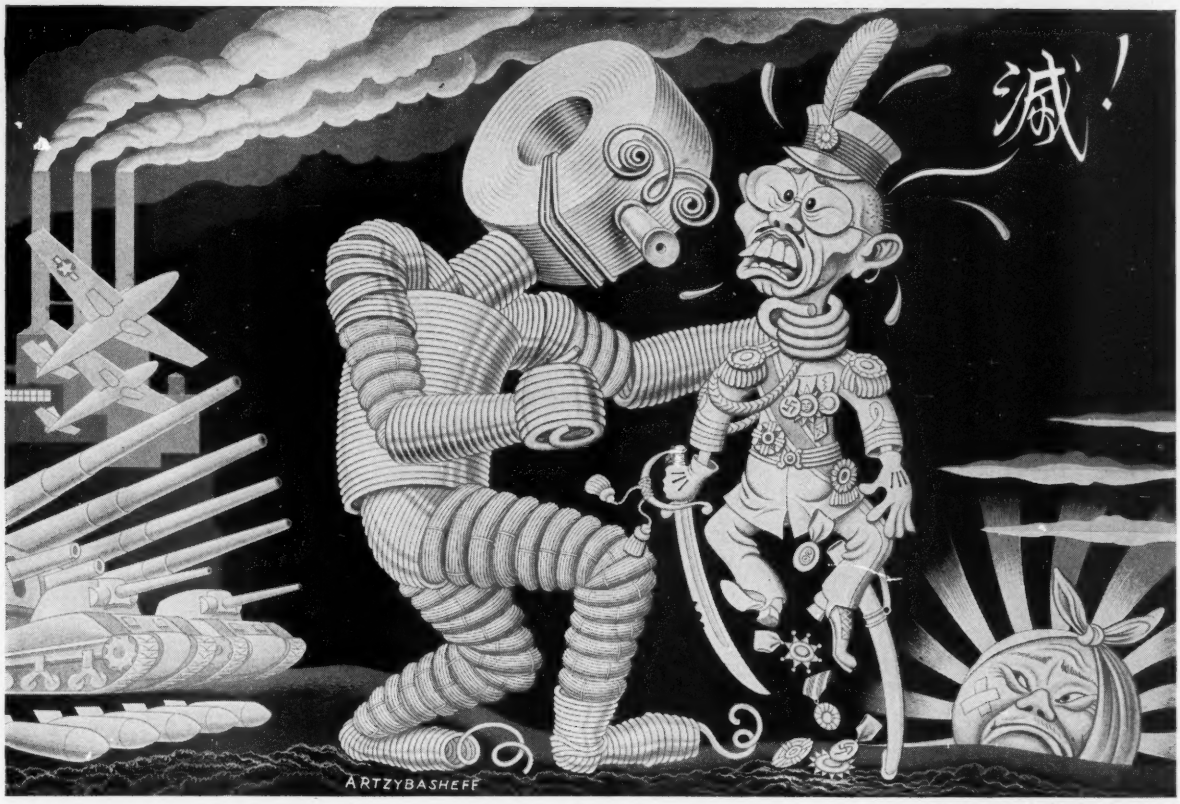
Another New Holden
Development
ELECTRODE FURNACE
With a
CERAMIC POT
for
WIRE ANNEALING
1
Heat from a Holden Bath penetrates to center of coil faster than circulating atmosphere
2
Important saving of time between charge and discharge
3
Closer control of temperature . . . Fluctuations minimized . . . More uniform physical properties
4
Maintenance costs reduced to a new low . . . Pot life ranges up to five years
5
No chipping necessary to remove material from sides of a Ceramic pot
6
Better quality . . . Cleaner product . . . Free from heavy scale
7
NO DE-CARBURIZATION

Engineers . . NEW HAVEN, 8, CONNECTICUT

Electric Pot Furnaces for Temperatures from 300° F. to 2350° F.

BROTHERS, LTD., MONTREAL


SHOP MEMORANDUM
TO: Purchasing
FROM: Wagner - Supt.
SUBJECT: Dies
Those Vascoloy-Ramet dies are giving us more production and much better finish - Better duplicate last order and keep ample stocks on hand—
Keep up the good work!
F.W.
Makers of
VASCOLOY-RAMET
CARBIDE TOOLS &
TANTUNG CAST
ALLOY CUTTING TOOLS
TANTALUM-TUNGSTEN CARBIDE DIES produce more tonnage with better finish. Time spent in shut-downs for die changes, and for polishing and re-cutting dies—all affect production. Tantalum-Carbide has a definite lubricating action—it reduces the tendency of the wire or rod to gall and seize as it passes through the die. Result: A smoother finish free from score marks!
Ramet
VASCOLOY RAMET CORPORATION
NORTH CHICAGO, ILLINOIS • DISTRICT SALES & SERVICE IN PRINCIPAL CITIES




*Enlarged reproduction free on request.*

# STEEL WIRE-WARRIOR

Wissco wire is ordinarily peaceful. Formed into springs, wire cloth, fence, rope and other products, it helps make life easier and better. But get it mad, and it becomes a weapon for war.

On the battlefronts today, Wissco-quality wire and wire products are adding to the fighting efficiency of planes, tanks, warships and guns. On the home front, Wickwire fence is protecting war plants. Woven into flexible metal conveyor belts, this tough wire is speeding factory output, cutting production costs. Shaped into its various forms, Wissco wire is serving in practically every industry.

The Wickwire Spencer blast furnaces, open hearths and five great plants are working day and night, producing vast quantities of tough steel wire and wire products for military needs. If you want steel wire, of any size, temper or analysis, let Wickwire Spencer's 122 years of accumulated skill in wire production help meet *your* needs.

**SEND YOUR WIRE QUESTIONS TO**

## WICKWIRE SPENCER STEEL COMPANY

**500 FIFTH AVENUE, NEW YORK (18), N. Y.**

**Abilene, Buffalo, Chattanooga, Chicago, Detroit, Houston, Los Angeles, Philadelphia, San Francisco, Tulsa, Worcester**

**STANDS FOR FRIENDLINESS**

Copyright 1943, Wickwire Spencer Steel Co.

# WIRE

## *Electro-Galvanized*

# *by* MEAKER

## *Process*

**High Carbon No Problem! Enjoy the Experience of Coating High Carbon Wire as Easily and Economically as Fence Wire** — *without affecting its physical properties*

**Thickness Accurately Controlled...**

3 oz. or .1 oz. per sq. ft. is obtained with equal ease.

**Coating will not Peel...**

Wire may be drawn down to finer sizes, twisted, bent or flattened after galvanizing.

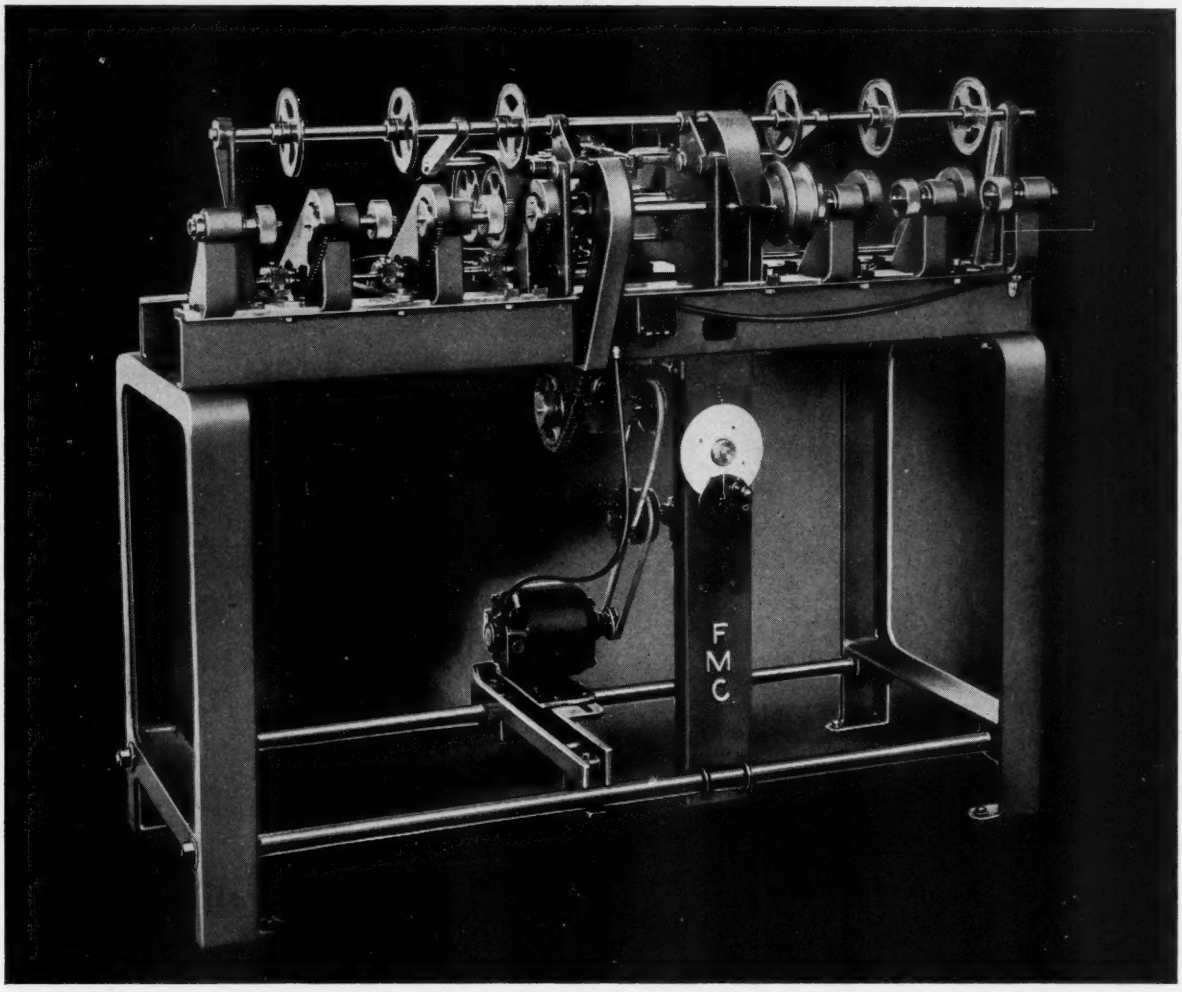
**Costs...**

for producing this quality galvanizing are less than the old conventional method.

Will *your* product have the advantage of this quality protective coating to meet Post War demands? More and more Meaker installations are being made with this in view. Ask Meaker for details.

**THE MEAKER COMPANY**

**1635 South 55th Avenue, CHICAGO 50**




# Another FIDELITY Machine— both a pacemaker and a peacemaker

—a pacemaker for production and a peacemaker for performance and delivery.

Illustrated is one of a number of types of FIDELITY Wire Spoolers which take care of an unusually wide range of wire winding requirements on spools, sticks, reels or quills.

FIDELITY Wire Spoolers deliver a smooth, uniform lay at speeds from 40 to 800 feet per minute—depending on kind and size of wire.

For tapered, wedge-end, or barrel-shaped packages on sticks or cores, FIDELITY Hydraulic Control Spoolers produce perfect self-supporting tapers which need no end flanges.

Special type FIDELITY machines for winding such things as plastic tapes, surgical thread, ultra-fine filament wires, etc., frequently combine additional functions like inserting the wound package into a container.

Write for new catalog of FIDELITY Wire Spoolers.

**BUY MORE BONDS**

ARMY E NAVY

33 YEARS' EXPERIENCE

*Designers and Builders of Intricate, Automatic Precision Machines*

**FIDELITY MACHINE COMPANY**

3908-18 FRANKFORD AVENUE, PHILADELPHIA 24, PA.

# ANNOUNCING!

# SILVERCOTE

## "SPRING GRADE"

## BERYLLIUM COPPER WIRE

The only wire mill in America specializing in the exclusive production of *guaranteed premium quality* beryllium copper wire.

### SILVER COATING MAKES A SIGNIFICANT DIFFERENCE

The special process developed by Little Falls Alloys to produce Spring Grade Beryllium Copper wire includes a silver coating which:

Reduces wear on coiling tools.

Increases surface electrical conductivity.

Reduces surface attack during hardening.

Silvercote Spring Grade wire is easy to identify at a glance. Silvercote Spring Grade offers production advantages not possible with any other beryllium copper wire.

### SILVERCOTE MEANS SPRING GRADE

Guaranteed Minimum tensile strength 185,000 # after hardening.

High Uniformity in Temper

Accurately Controlled Conductivity

Meets Higher Specifications than established ASTM standards

Little Falls Alloys, Inc. guarantees Silvercote Spring Grade to be the finest beryllium copper wire ever offered to American industry.

### PRODUCED IN A MILL USING RADICALLY UNCONVENTIONAL METHODS

The Little Falls Alloys plant produces nothing but beryllium copper wire—Spring Grade. This premium quality wire involves the use of special furnaces, unique wire drawing equipment, special lubricants, and special cleaning and pickling equipment.

Increased productive capacity now makes it possible to offer Silvercote Spring Grade for general use throughout industry.

### DELIVERIES NOW BEING MADE IN 4 TO 6 WEEKS (AA-1)

Present available sizes .0359" to .010."

Sizes .0201 and under supplied in spools — average weight 10 lb.

PHONE OR WRITE TODAY— FOR PRICE SCHEDULE AND SPECIFICATIONS

## Little Falls Alloys INC

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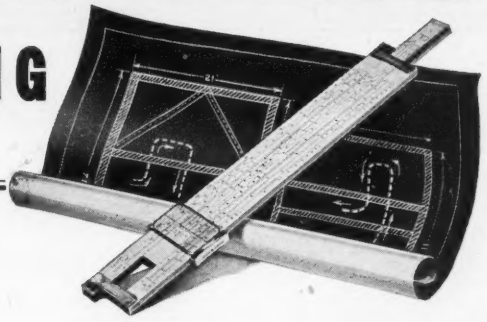
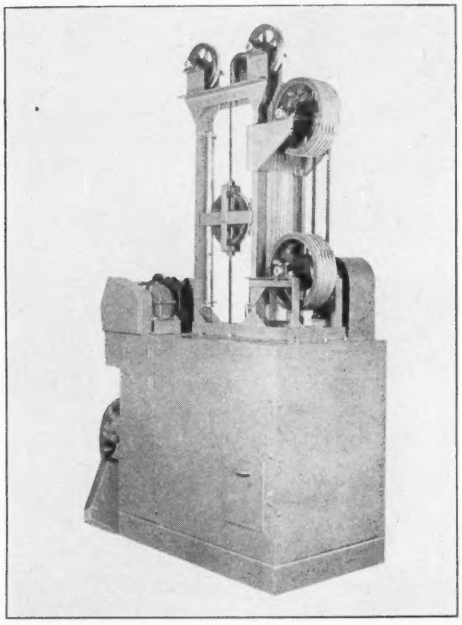
# OVEN ENGINEERING NEWS



## New Wind-up Machine Achieves Constant Speed and Tension on Wire, Cable, Textiles, Tapes



One year ago, when the Industrial Oven Engineering Company designed its first cable lacquering tower, industry was given a new conception of speed and efficiency in the impregnation and coating of insulated wire and cable.

At the same time, to meet strict Army-Navy specifications for uniform and concentric finishes, Industrial Oven designed and built a new type constant-speed, constant-tension wind-up machine, superseding the makeshift devices which had previously actuated cable lacquer systems. This machine, shown above, is now made in two standard sizes, and can be adapted for the wind-up of cords, rope, cable, paper, tapes of various kinds, textiles and coated fabrics.

**(Note: One unit is available in our plant for experimental runs of customers' materials. Contact us for appointment.)**

### Wide Tension Range

This wind-up machine is a complete, self-contained unit with combination variable speed and hydraulic synchronizing equipment, designed to provide constant speed and constant tension within a variable production range. By arrangement of adjustable counter-weights, wire tension can be varied from a few ounces to hundreds of pounds. It comprises a dismountable reel stand, multi-wrap large-diameter capstans, constant but variable tension mechanism and an adjustable lever winder, and is also equipped with provisions for driving assisting capstans which are required on some grades of fine wire being processed through multi-coated finishes. It is motor driven and requires no outside source of power or synchronization.

### For Extrusion Wind-up

It is available in higher operating speeds for extrusion wind-up in the use of rubber or synthetic insulation materials, and continuous wind-up machines of the same basic design with high-speed cross-over are available.

### Standard Sizes:

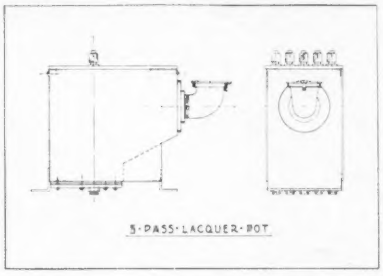
No. 1—24″ to 36″ diameter reel sizes.
No. 2—14″ to 22″ diameter reel sizes.

Similarly efficient unwind stands are also supplied in standard sizes for semi-automatic operation. The operator simply rolls the reel into position and steps on a foot pedal to raise the reel and set a counter-weighted tension brake simultaneously.

### Lacquer Pots

Supplied either as part of Industrial Oven lacquer systems or for independent use, the lacquer pots shown here are designed for single or multi-pass lacquering, and are furnished in single-pass, standard for saturation, and 5- and 6-pass, standard for lacquering. Other units can be furnished for any number of passes.

Use of these pots will assure 100 percent coverage of braid, and positive wiping to reduce excessive lacquer coating. Lacquer frothing and blushing of finishes are considerably reduced by proper control of lacquer eddy currents and lacquer disengagement prior to wiping.




These component parts—wind-up machine, unwind stand and lacquer pots—function as one unit when used with an Industrial Oven Engineering Company high-speed lacquer tower. Together they form the correct combination of functionally engineered equipment for lacquering, varnishing, or otherwise impregnating insulated wire and cable, as well as a large number of other materials handled in continuous lengths.

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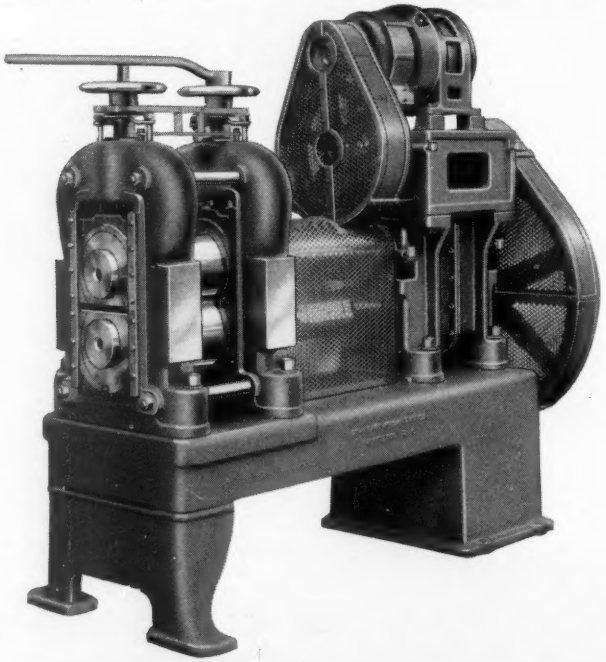

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These Pickle Bath Toners, in both the powder and liquid grades, are furnished with and without inhibitor action. The uninhibited types are recommended where the advantages of the Pickle Bath Toner can be combined with the many advantages of the inhibitor, Rodine. In such cases the Toner *and* the Rodine are added to the new pickle bath and as future additions of acid are made only the Rodine is added.

In a few operations where strong inhibitor action is not required, for example in cold pickling solutions, or where actual attack or "etching" of the metal is wanted for subsequent operations, the use of the mildly inhibited form of Toner is recommended to obtain the improved cleaning action and still retain sufficient inhibition to prevent excessive etching.

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While ACP Pickle Bath Toners will be generally beneficial there are several operations where little inhibitor action is deemed necessary, including electroplating, galvanizing, pickling in cold solutions or in some electrolytic pickling units, etc. In addition, Pickle Bath Toners also improve the penetration, the wetting and the spreading action of zinc or ammonium chloride fluxes in preparation for galvanizing, tinning, etc.

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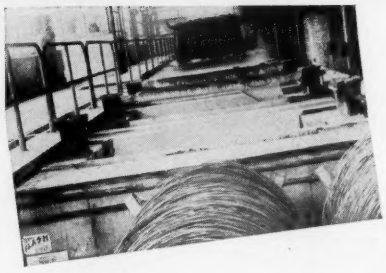

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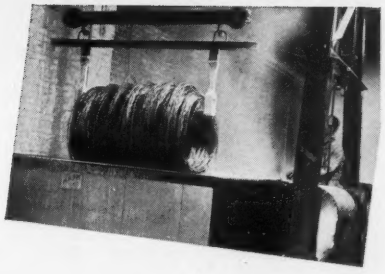

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Vol. 19 JANUARY, 1944 No. 1

Designated as

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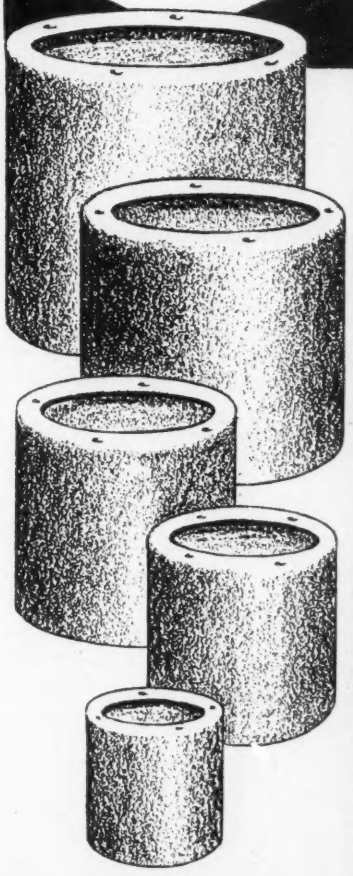

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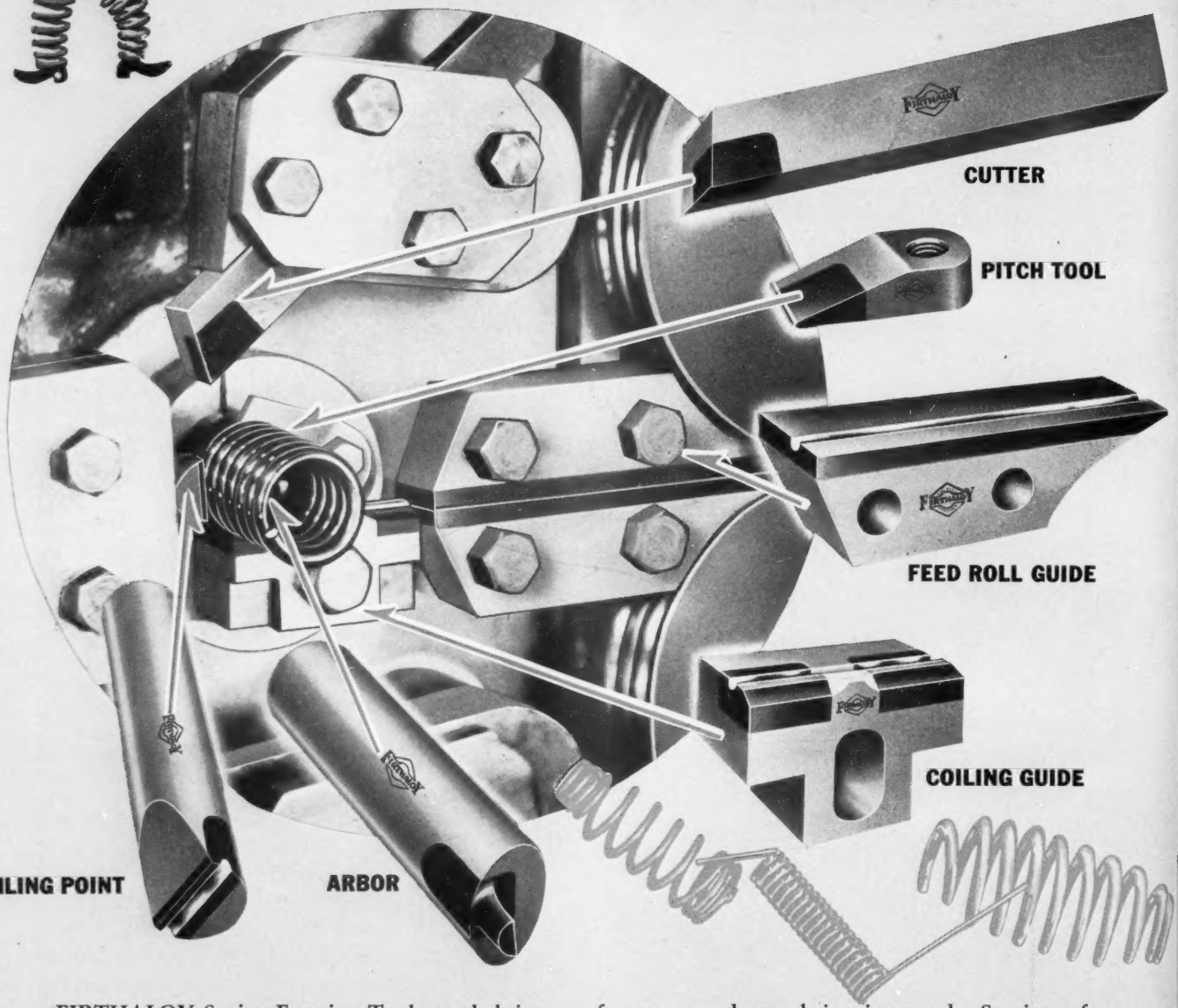


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DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 19 JANUARY, 1944 No. 1


# The Wire Drawing Die


By Flint C. Elder,
Special Research Engineer,
American Steel & Wire Company, Cleveland, Ohio.


## THE MORDICA MEMORIAL LECTURE
— 1943 —

MR. Chairman, Members of the Wire Association, and Guests:

✦ ✦ ✦

I APPRECIATE the honor of being chosen by the Board of Directors of the Wire Association to present this year the Mordica Memorial Lecture. I appreciate this honor the more because this lecture is given to honor the memory of **John Mordica,** the first President of this Association, whose ability as a Plant Manager was respected and whose friendship was valued by all of us who knew him.

✦ ✦ ✦

THE Wire Drawing Die, while one of the smallest tools used in the Wire Industry, is one of the most important, if not the most important. Those of us familiar with the production of wire know that the first move made by the experienced wire drawer when confronted by a difficult wire drawing job is to check the die shape and in the case of trouble to suggest to the die room some change in the die shape. True, the wire drawer may be wrong in questioning the die shape as the cause of his difficulty and he may be wrong in suggesting to the die maker that particular change in die shape but at least it is significant that from his long experience in wire drawing he does first question the die shape in time of trouble.

**While the subject of this lecture is the wire drawing die, the scope of it will be limited to the tungsten carbide die as used in the dry drawing of steel wire of circular cross section as distinguished from shape wire.** ✦ ✦ ✦ ✦ ✦

✦ ✦ ✦

WE propose, therefore, in this paper to discuss the shape of the die—or, more precisely, the contour of the hole in the die—in relation to its effect on the drawing of steel wire.

✦ ✦ ✦

AS generally made today, the tungsten carbide die consists of a tungsten carbide nib set in a suitable metallic mounting with the axis of the die hole normal to the face of the mounting. The die hole itself consists of four sections. First, starting at the entrance of the die hole, is the section generally known as the bell. Next in order comes the section known as the entrance angle or the approach angle. Third, is that part of the die hole known as the bearing and fourth, the section at the exit of the hole which is known as the relief angle or the "backing out."

✦ ✦ ✦

THE section of the die hole known as the bell is put in the tungsten carbide nib at the time the nib is produced, and therefore, is already in the nib as received by the die room. Its function is chiefly to permit the lubricant to be drawn into the die hole during the actual wire drawing operation. Inasmuch as the wall of the bell does not normally come in contact with the wire being drawn, at least not when the wire is being reduced in cross section, we will not consider that section in this paper.

# IN MEMORIAM

**JOHN MORDICA**
**1873 - 1937**

THE section of the die hole known as the entrance angle, however, is most important since it is here that the wire being drawn first feels the pressure from the wall of the die hole and it is here, in fact, in the modern tungsten carbide die where the entire work of reducing the steel wire to the desired size takes place. Our paper, therefore, has chiefly to do with this section of the die hole and the effect that angles of different degrees from the largest to the smallest have on the wire drawing operation.

✦ ✦ ✦

THE section of the die hole known as the bearing has as its principle function the maintenance of the die hole size, and, inasmuch as its taper, usually only a matter of a degree or two, is contrary to the direction of wire drawing, no actual reduction takes place in this section; so we will consider it only briefly. Similarly the exit section of the die hole known as the relief angle or the "backing out" will not again be considered in this paper since it takes no direct part in the reduction of the wire and its function is adequately described by its name.

✦ ✦ ✦

THE method we have adopted in this paper of studying the effect on wire drawing of entrance angles of various degrees is that of noting the effect on the force to draw wire which we shall refer to hereafter as die pull. Obviously this pull is made up of two components: first, that force which is required to deform the wire being drawn from its starting size to its finished size, and second, that force which we must apply in addition to the force of deformation in order to overcome friction. In brief, therefore, we may state our formula for die pull as follows:

**Die Pull = $F_d + F_f$**

**Where $F_d$ stands for the force of deformation and $F_f$ the force necessary to overcome friction.**

✦ ✦ ✦

LET us first consider $F_d$, the force necessary to deform the wire, not including the element of friction. The writer has always been impressed with the similarity, real or apparent, between drawing a wire by means of a die and the stretching of a wire to size merely by a straight tensile pull. This latter can be accomplished with fairly uniform gauge providing the reduction attempted is within certain more or less well defined limits. Others also, who have investigated the force necessary to draw wire and have developed a formula for this force or die pull, have mentioned this similarity.

✦ ✦ ✦

THE force necessary to stretch a wire from one size to a smaller size can best be demonstrated in a tensile machine. A dead soft annealed low carbon steel wire of about .07% carbon and .189" in diameter such as we have used in some of our die pull tests, was placed in the jaws of a tensile machine and subjected to a straight tensile pull after first attaching to the wire a strain gauge so arranged as to automatically record the load or stress as well as the corresponding stretch or strain continuously throughout the operation up until the wire broke. By such means we obtained what is known as a stress-strain diagram of the wire, a reproduction of which is shown here. (Figure 1).

**FLINT C. ELDER**

**Born in Paris, Me., September 6, 1882. Educated in public schools at Malden, Mass., and attended Massachusetts Institute of Technology and Columbia University of Mines, obtaining Metallurgical Engineer's degree. Entered employ of American Steel & Wire in 1911 as an assistant in the physical laboratory at South Works, Worcester, Mass. Transferred to Cleveland in 1917 as chief of the physical laboratory at the company's Newburgh Wire Works where he rendered invaluable service during World War I testing shell steel going into ammunition for our armed forces. In 1919 transferred to Pittsburgh as metallurgist and seven years later was again moved to Cleveland in the same capacity. Was named chief metallurgist of the company in 1934 and a month later was named director of research. In 1942 was appointed special research engineer which position he still holds. A member of A.S.T.M. since 1910 and also a member of American Institute of Mining and Metallurgical Engineers, American Iron and Steel Institute and The Wire Association.**

✦ ✦ ✦

LET us examine this stress-strain curve. In the horizontal direction is shown the stretch or, as it is termed, the strain of the wire. In our recording mechanism this is magnified so that 1" on the chart represents 1% elongation in the 10" original length of wire to which the strain gauge was fastened. Similarly, 1" in the vertical direction on the chart represents increments of 200 lbs. in load. If now we start at the beginning of the curve and proceed along its length we note as the length of the wire increases, the load correspondingly increases at a uniform rate until a point is reached marked by the arrow where the rate of elongation changes. This point is known as the proportional limit and also practically coincides with the elastic limit or the point where if the load is released, the wire will return to its original length and beyond which it will take a permanent set.

✦ ✦ ✦

THIS is the first point of interest since we have good reason to believe that the wire entering the approach angle of the die must reach at least this load or stress before it will take a permanent reduction. However, this stretch is not significant for our purpose until we reach on the curve the point corresponding to 0.2% offset which is commonly called the yield strength or that load at which the wire will take a permanent elongation of 0.2% and, of course, a corresponding reduction in its cross sectional area. From this point on the rate of elongation changes at an ever increasing rate until a point is reached where it changes so fast that there is little or no increase in load. This is the yield determined by the drop of the beam on the lever type of testing machine, or by a halt in the dial indicator on a hydraulic machine. In this test which was made on a hydraulic

type of testing machine the yield point occurs at approximately 900 lbs. or 32,000 lbs. per square inch of original cross section.

✦ ✦ ✦

AS noted on the curve the load remains fairly constant until the end of the yield point which occurs at a total elongation of approximately 2% on the chart. As the wire is strained beyond this point a more or less uniformly increasing load is required as the stretch increases until the maximum load is reached, referred to as the maximum breaking weight of the wire.

✦ ✦ ✦

ON the chart this occurs at a load of 1370 lbs. or about 49,000 lbs. per square inch of original cross section. At this maximum load the elongation was 22% and the corresponding reduction in cross sectional area can be figured from the equation:

$A_1 L_1 = A_2 L_2$

where $A_1$ and $L_1$ are the original area and length, and $A_2$ and $L_2$ the corresponding final dimensions.

Then if $A_1 = 1$ square inch and $L_1 = 1''$

$A_1 L_1 = (A_2)\ (1.22)$ or

$A_2 = \frac{(A_1)\ (1)}{1.22} = .82A_1$ or

a reduction of 18% (approximately)

**TABLE I**

| Reduction in Area | Pull Actual Lbs. | Pull Lbs./Sq. Inch |
|---|---|---|
| For 0.2% (approx.) | 800 | 28,500 |
| For 2.0% (approx.) | 900 | 32,000 |
| For 2% — 18 (approx.) | 900 to 1370 | 32,000 to 49,000 |
| For 18% or more | | 49,000 |

IN other words, we have found that it requires a tensile pull of 1370 lbs. or 49,000 lbs. per square inch on the original cross section of this wire to effect a reduction of approximately 18%. Moreover, we cannot further increase the load on this wire. From now on as we continue to stretch the wire, the load continuously falls off as the wire "necks down" until the final break occurs at the necked down portion of the wire.

✦ ✦ ✦

NOW, to recapitulate. On the dead soft annealed wire of .189" diameter the following tensile pulls are required to effect the permanent reductions in cross sectional area as shown in Table I.

✦ ✦ ✦

WE are well aware that we have gone into some tedious detail in studying the stress-strain diagram of this wire, but we consider it important because we expect to use this information in calculating the pull necessary to deform this wire in drawing it through a given die.

✦ ✦ ✦

LET us now consider the actual case of drawing a piece of this same wire through a die of size .142" with an approach angle of 22°. For this purpose, to stretch the wire we used the hydraulic testing machine and the autographic recording strain gauge running the machine at the same speed as before, a fixed loading speed of 300 lbs. per minute which after the wire started to draw gave a drawing speed of approximately ¼" of finished .142" diameter wire per minute. This, we believe, is a record for slow production of wire but yet a speed which we felt justified in view of the precision we were attempting to obtain in determining the die pull and its component parts as affected by the die hole shape.

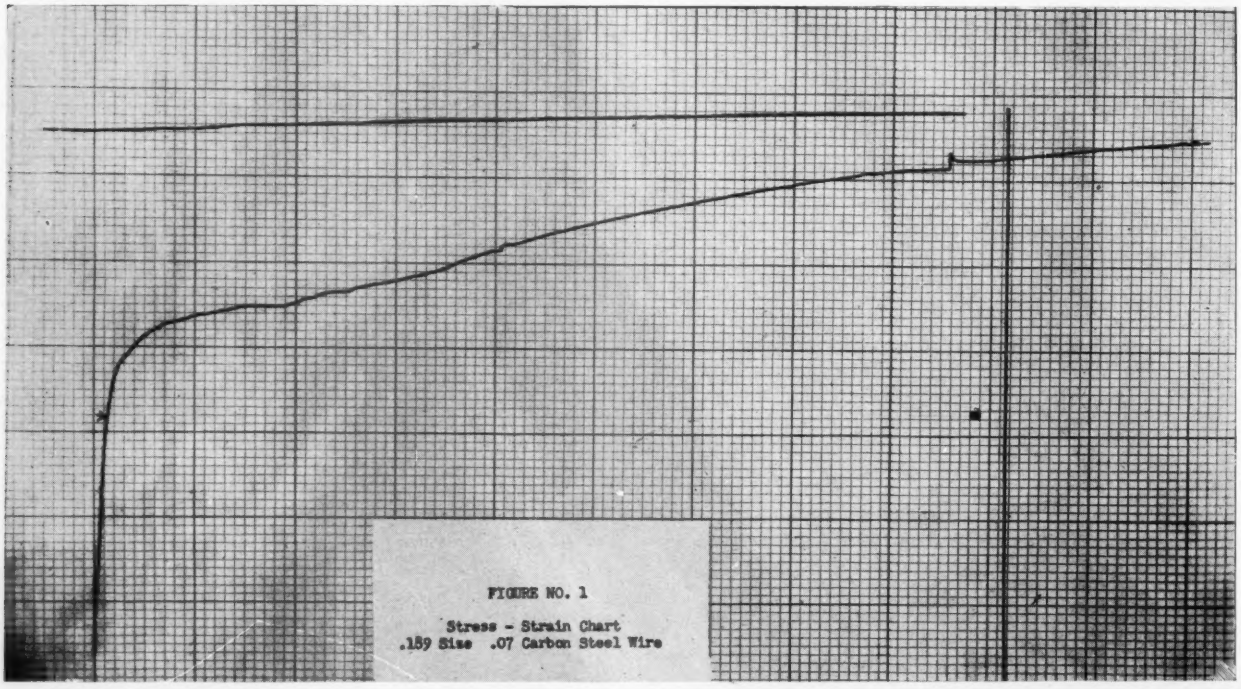

FIGURE NO. 1

Stress - Strain Chart
.189 Size .07 Carbon Steel Wire

Abscissa 1" = 1% in 10"
Ordinate 1" = 200 lbs.

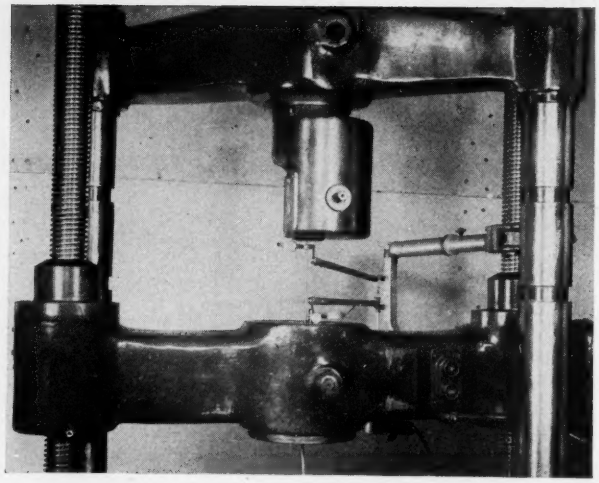

Fig. 2. Hydraulic Testing Machine Showing Wire in Position to be Drawn. (1st View)

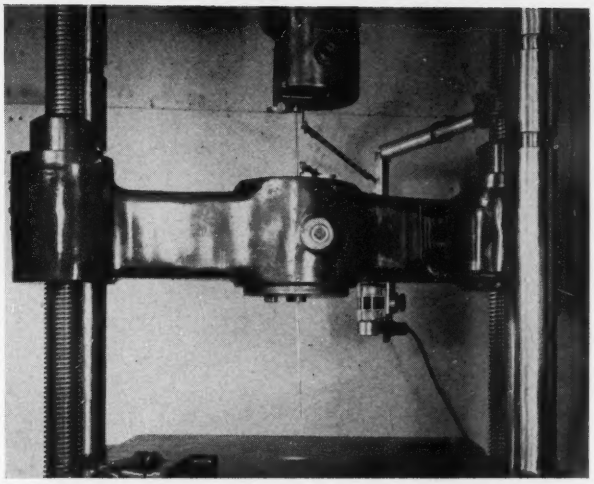

Fig. 3. Hydraulic Testing Machine Showing Wire in Position to be Drawn. (2nd View)

THE procedure consisted of drawing by means of the hydraulic testing machine a sufficient length of wire, approximately 15 to 18″ of .142″ diameter, enough to allow a 10″ gauge length of wire between the exit side of the die and the grip in the upper jaws. In place of the lower jaws we used a heavy plate with a recessed hole into which the die was seated after the plate had been bolted onto the lower cross head. The starting end of the wire was pushed through the die hole, fastened in the top jaws of the machine, and an initial load put on the wire in order to seat it firmly on its contact surface in the die. The strain gauge was then attached, one end to the wire itself and the other end to a rod which had been screwed onto the same plate which contained the die. In other words, one end of the gauge was attached to a fixed point that represented the die itself and the other end to the wire so that the instant the necessary load was attained on the wire and the wire started to draw, it would be recorded on the chart of the autographic recorder. (Fig. 2 and 3).

WE show in Fig. 4 the chart obtained in this operation of drawing dead soft annealed low carbon steel wire of .189″ diameter coated with a mixture of lime and calcium stearate, which had been baked onto the wire, through a well polished tungsten carbide die with an approach angle of 22° and a hole diameter of .142″. This corresponds to a reduction in area of 43½%.

✦ ✦ ✦

FROM the curve on this chart it is noted that no wire comes out of the die until a load or pull of about 700 lbs. is reached. Then the wire starts to draw but a constant pull is attained at about 10-15 lbs. higher, or 715 lbs. which we will consider to represent our die pull.

✦ ✦ ✦

NOW we will compare directly this chart with the one we made of the original .189″ size wire, since the dimensions on the chart are the same in both cases, 1% stretch in 10″ for the horizontal component and 200 lbs. per inch of height representing the load. As we compare the two charts we are impressed by the fact that in the case of the first wire it took a pull of 1370 lbs. to effect a reduction of only 18% whereas in drawing this same wire through a 22° die it took a pull of only 715 lbs. to effect a 43½% reduction in spite of the frictional effects.

✦ ✦ ✦

HOWEVER, we must remember that a die is a mechanism like a lever or a wedge, and like all mechanisms, in spite of the fact that the applied force is very much less than the resisting force, yet the work done in the two ends of the system must be equal. Now, if work, which is a force multiplied by the distance through which it moves, is the same, then the distance through which the force moves is different in proportion. Such is the case in the drawing of wire where we know that if we take say a 50%

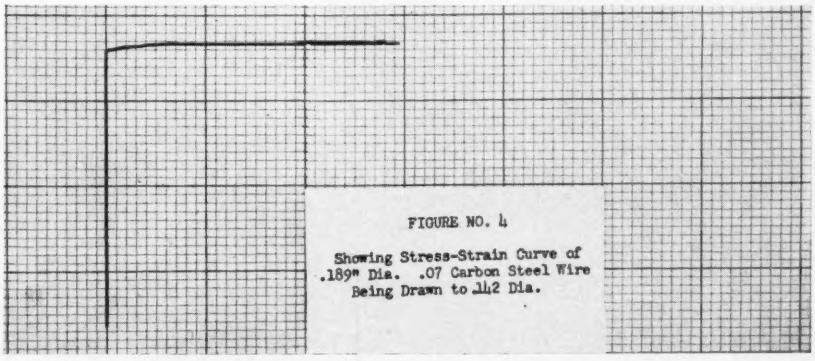

FIGURE NO. 4

Showing Stress-Strain Curve of .189″ Dia. .07 Carbon Steel Wire Being Drawn to .142 Dia.

Abscissa 1″ = 1% in 10″
Ordinate 1″ = 200 lbs.

draft, we will have approximately twice the length of wire coming out of the die as it went in, and if we take a 25% draft, we will have 100 divided by 75 or 1⅓ times the length of wire coming out of the die as went in. Hence, we know that a die is a mechanism of the general class described.

✦ ✦ ✦

NOW, let us consider the forces operating inside the die which cause the wire to be reduced in cross sectional area and elongated. As the wire enters the die and as it first comes in contact with the die wall, it starts to be reduced and elongated at a uniform rate as it proceeds down the die wall. The increase in force, however, to effect this elongation or reduction is not constant since we have learned from our stress-strain diagram of the original .189" diameter wire that the force necessary to produce this stretch or reduction in area is constantly increasing but not at a uniform rate, the first 0.2% stretch or reduction requiring 800 lbs., at 2.0% reduction 900 lbs. being required and from there on up to 18% reduction a practically uniformly increasing pull until 1370 lbs. is reached. From there on there is no further increase in load until the maximum reduction takes place or the wire breaks.

✦ ✦ ✦

NOW we can calculate the average tensile deformation as follows: 2% of the total of 43½%, or approximately 4½% of the total, requires approximately a 900 lbs. pull, the next 16% reduction or approximately 37% of the total requires an average pull which is half way between 900 and 1370 or 1135 lbs., and the remaining reduction or 58½% of the total requires a 1370 lb. pull.

| | | |
|---|---|---|
| 4½ | x 900 = | 4050 |
| 37 | x 1135 = | 42000 |
| 58½ | x 1370 = | 81500 |
| 100 | | 127550 |

✦ ✦ ✦

AVERAGE pull of deformation $= \frac{127550}{100} = 1275$ lbs. This pull of 1275 lbs. required to deform this wire in the die is equal to 45500 lbs. per square inch of original wire cross section. Since the original .189" diameter wire had a maximum breaking strength of 49,000 lbs. per sq. inch, the average deforming pull inside the die is $\frac{45500}{49000}$ x T.S. or .93 x T.S.

✦ ✦ ✦

HAVING found by the above means the average tensile load the wire must have received inside of the die to deform it, (1275 lbs.), we now note that this figure compares very closely with the maximum breaking weight of the drawn .142" size wire, (1225 lbs.). The difference, a matter of about 4%, is well within our probable error in calculating the average deformation pull. Checking this observation with other die pull tests we are lead to the belief that what we have called the average deformation pull is identical with the breaking weight of the finished drawn wire. Consequently, we can arrive at it very simply since all wire producers have charts showing gain in tensile strength due to drafting.

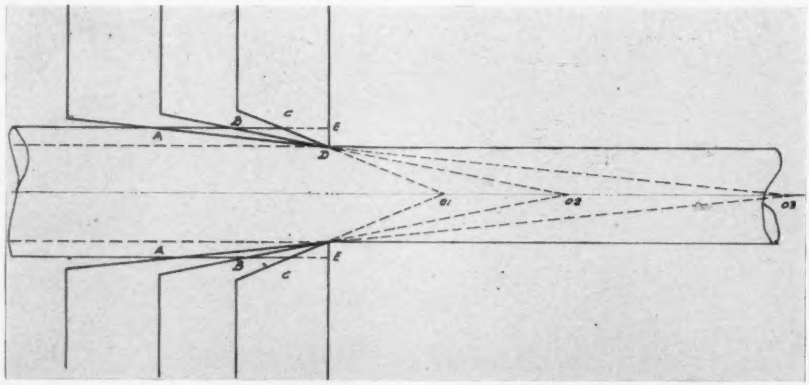

Fig. 5. Showing a Diagram of a Wire Being Drawn to the Same Diameter Through Dies with Three Different Approach Angles (approx. 10°, 20°, 40°).

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WE can now write our formula:

**Die Pull = $P_d + P_f$**

**Where $P_d$ = Average pull of deformation and $P_f$ = Pull to overcome friction.**

**Die Pull = $F_d$ (A — a) + friction**

**715 = 555 + friction**

**Friction = 715 — 555 = 160 lbs. or 22½%**

**Where $F_d$ = Deforming Strength in lbs. per sq. inch**

**A = Area before reduction**

**a = Area after reduction**

✦ ✦ ✦

HAVING found means of obtaining the force and hence the part of the pull due to deformation of the wire and having arrived at the friction in the die by the expedient of subtracting the deformation pull from the total die pull, the latter determined by experiment, we must find means to calculate the friction in the die. The forces due to friction without doubt increase with the pressures in the die which act at right angles to the die wall. Up to now we have spoken of tension rather than compression in drawing the wire through a die and arriving at the average tensile force required to elongate or reduce the wire because we apply tensile force on the drawn wire in a direction parallel to the axis of the die. Perhaps our speculation that the wire drawing operation is merely application of a tensile load to the wire in the die until it stretches sufficiently to pull through the die opening, is not unwarranted. There can be no doubt, however, that the die walls exert pressure on the wire, causing friction which increases with the pressure but acts along a direction parallel to the die wall. If we apply this pull parallel to the axis of the die, as we do, instead of down the wall face, this friction pull will be slightly less; i.e., in relationship of the horizontal side of the triangle

of forces to the slant side. This corresponds to the cosine of the half angle, in this case, cos of 11° which is .985.

✦ ✦ ✦

WE now come to the question of the area of contact between die and the wire. The area of contact is the area of the surface of a frustrum of a cone which is equal to $\frac{1.57\ (D + d)\ (D - d)}{2 \text{ sine of } \frac{1}{2} \text{ angle}}$ but in our formula we now have the angle affecting the friction first, in proportion to the cosine of the half angle with regard to a change of direction of force; and second, inversely as the sine of ½ angle with regard to the area of contact. The net result of the angle effect is cosine ½ angle divided by the sine of ½ angle, which is the cotangent of the ½ angle.

✦ ✦ ✦

THE next item is the coefficient of friction, which is the factor by which we multiply our total pressure to obtain the actual friction. Our formula now becomes:

**Die Pull = $D_f R$ (1 + cotangent of ½ angle x cf)**

✦ ✦ ✦

WHERE R = Reduction in area expressed as a fraction of the whole. As written above, $D_f$ is actual pounds. If expressed in the formula as pounds per square inch, the formula becomes:

**Die Pull = $D_f$ A R (1 + cotangent of ½ angle x cf)**

THE sketch, Fig. 5, illustrates the effect of three different angle sizes on the areas of contact, all of them producing the same total reduction on the wire. These angles were laid out so that the largest is about 40°, the next about half that or 20° and the smallest about 10° or ¼ of the largest angle.

✦ ✦ ✦

ANOTHER way to illustrate the effect of the angle of contact may be shown by a stress-strain chart of the last end of a piece of wire going through the die. Our first chart showing a wire going through the die, Figure 4, disclosed only a vertical rise in force before actual drawing commenced. However, we conceived the idea of cutting the wire off so as to leave a square end with no burr and then continuing our drawing operation recording the stress-strain diagram until the wire had completely passed through the die hole. We show these charts, Figures 6, 7, 8, 9, 10, for five different angles: 45°, 28°, 10°, 8°, 6°, respectively.

✦ ✦ ✦

YOU will observe in the 45° die, (Fig. 6), the load drops very abruptly as the wire passes through the die whereas the rate of drop is much lower in the smaller angle dies. Since all the specimens were prepared from only a short length of wire, neither the physical properties nor the surface condition of the original wire could have varied appreciably throughout the test; thus, the effect of passing the wire through dies of various approach angles is clearly indicated.

✦ ✦ ✦

IT is also interesting to note that the point on the curve where the load commences to drop is the position just as the sawed end of the wire disappears into the approach angle of the die hole or more exactly, the spot where the end of the wire just leaves the original point of contact. The load falls off fairly uniformly as the area of contact decreases. This is particularly offset by a slight increase in the deforming pressure, but this is only slight we believe and is largely overshadowed by the drop in A or starting area as the wire passes down the approach angle.

✦ ✦ ✦

IF we take the area vertically under these end drawing diagrams we will obtain an idea of the work done by the die on the wire as it passes through.

✦ ✦ ✦

ANOTHER interesting point is a study of the ends of these wires after they have left the dies. The ends of wires drawn through the smaller angle dies show a nearly square end almost unchanged from what they were when they went into the die, while the larger angles, especially the 45° angle, produce a wire with an end showing a definite cup. This indicates,

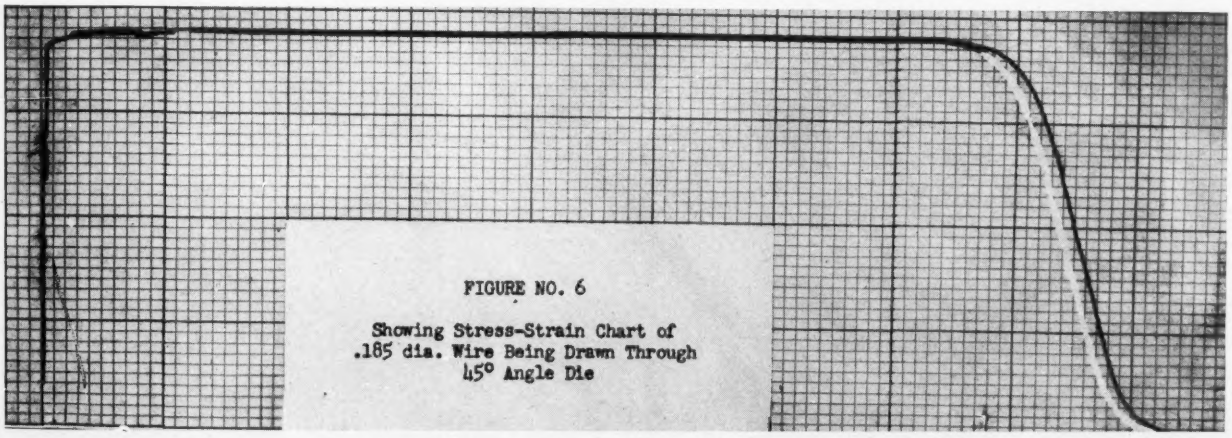
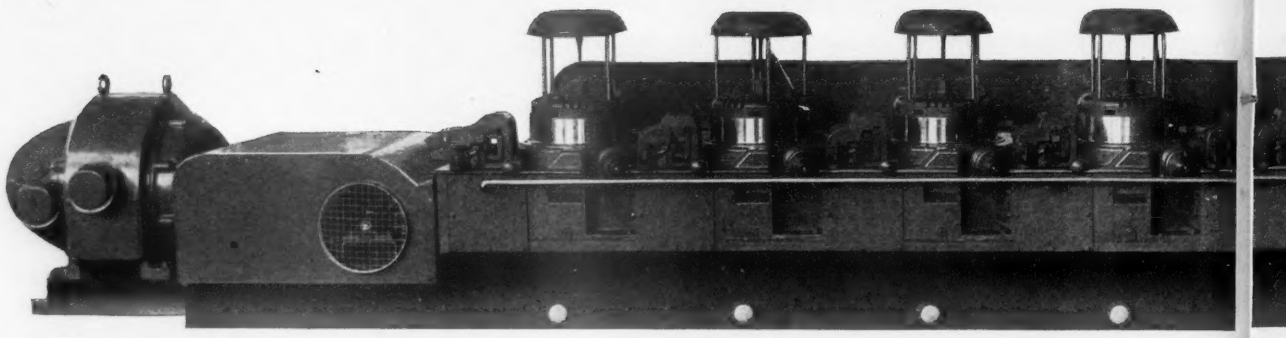


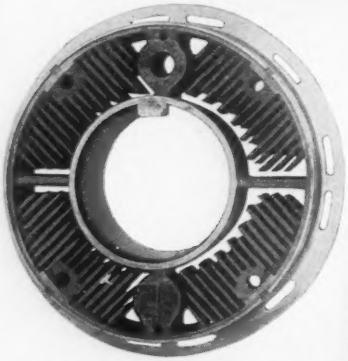
FIGURE NO. 6

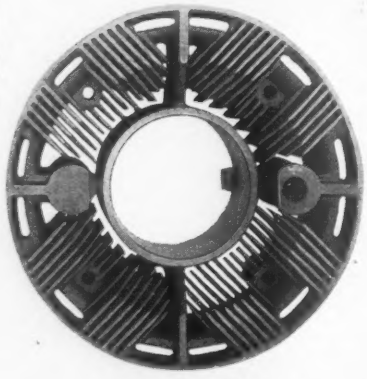
Showing Stress-Strain Chart of .185 dia. Wire Being Drawn Through 45° Angle Die

Abscissa 1" = 1% in 10"
Ordinate 1" = 200 lbs.

# WIRE AND WIRE PRODUCTS





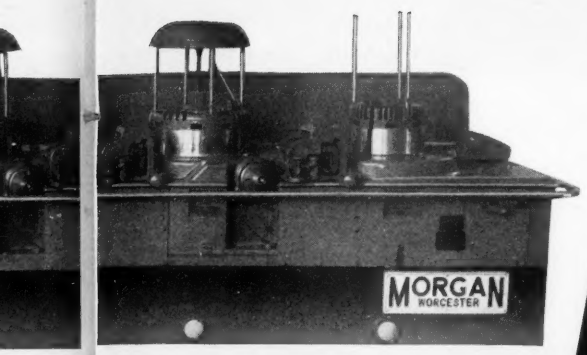


MORGAN (Patented) FIN-TYPE AIR COOLED BLOCK presents a large radiating area to insure fast dissipation of heat. Air, impelled by fan, passes upwards through the fins and through the inside of the coil on the block. Additional air is blown on the wire on the outside of the block at the draft line. Rapid and complete cooling of the wire results.

TYPE B W
MORGAN-CONNOR WIRE MACHINE

For continuous drawing of high carbon or low carbon wire. Special features include the following:

1. Maximum starting sizes: 1/4" low carbon. #4 high carbon patented to 170,000 #/in$^2$.
2. Machine designed for 4, 5 and 6 drafts.
3. Interchangeable finishing blocks.
4. Machine is designed to draw from welded bundles.
5. High block design, with patented Fin Type Air Cooled Blocks.
6. Fully adjustable die boxes for casting wire.
7. A.C. or D.C. motor.



MORGAN
MOTOR-DRIVEN POINTER

Capacity:
No. 5 rod - .055"

This is one of several types of pointers available, including a hand-operated model.

NOTE:

MORGAN CONSTRUCTION COMPANY manufactures a complete line of wire drawing machines and accessories, including Morgan-Connor Wire Machines, Vertical Spindle Bull Blocks, Horizontal Bull Blocks, Take-up Frames, Pointers, Reels, Grips and other wire Drawing Accessory Equipment.

MORGAN WEDGE GRIP
Complete with hook and chain.

One of several types and sizes each employing powerful double wedge action which closes and holds <u>two</u> wedge jaws against the point. The harder the pull, the tighter the grip!

MORGAN CONSTRUCTION COMPANY
ENGINEERS AND MANUFACTURERS
ROLLING MILLS-WIRE MACHINERY-GAS PRODUCERS-COMBUSTION CONTROLS
WORCESTER, MASSACHUSETTS, U.S.A.
WIRE MACHINERY DEPARTMENT
15 BELMONT STREET
CABLE "MORGAN"



enclosing photographs and data covering some of the outstanding ... As you well know the sale of all

we believe, an incipient cuppy condition in the wire.

✦ ✦ ✦

THE question of compressive shearing force, we believe, enters very largely into this action of the short blunt taper of the large angle. This is demonstrated not only in the appearance of the end of the wires but also in the finish of the wires drawn through these five different angles. The coating on the wire drawn through the 45° die was almost completely worn off and the wire was very bright and shiny; on the other hand, the coating on the wire drawn through the smaller angle dies was very good, being the heaviest on the smallest angle die despite the fact that in this die the wire had farther to travel down the wall of the approach angle. We believe, therefore, that the shearing effect increases the coefficient of friction as the die angle is increased due to the removal or nearly complete removal, of the coating which accounts for the increased pull of the dies with larger angles. However, the increased pull of the smallest angle die which, in the case of some instances of a heavy draft with a minimum angle resulted in breaking of the wire drawn, results from the increased area of contact, we believe.

✦ ✦ ✦

WE should mention here that in these tests shown above, all dies had the same length of bearings, the 1 to 2° reversed tapered portion of the die hole which controls the die size maintenance. This bearing length was about equal to the diameter of the die holes.

IN regard to die hole maintenance, the life of a particular die hole is only partially affected by the length of bearing. The other factor we believe these tests have indicated is that the large angle die, which affects or apparently affects the coefficient of friction by removing the coating, also wears out more quickly the die hole itself. Since the work takes place, in the case of the large angle die, over so short or small an area we would naturally expect this result, while the reverse would be the case in the smaller angle dies since the work is spread over a very much larger area of contact between the die and wire.

✦ ✦ ✦

IN this investigation we have made many die pull tests over a considerable range of reductions from approximately 45% down to

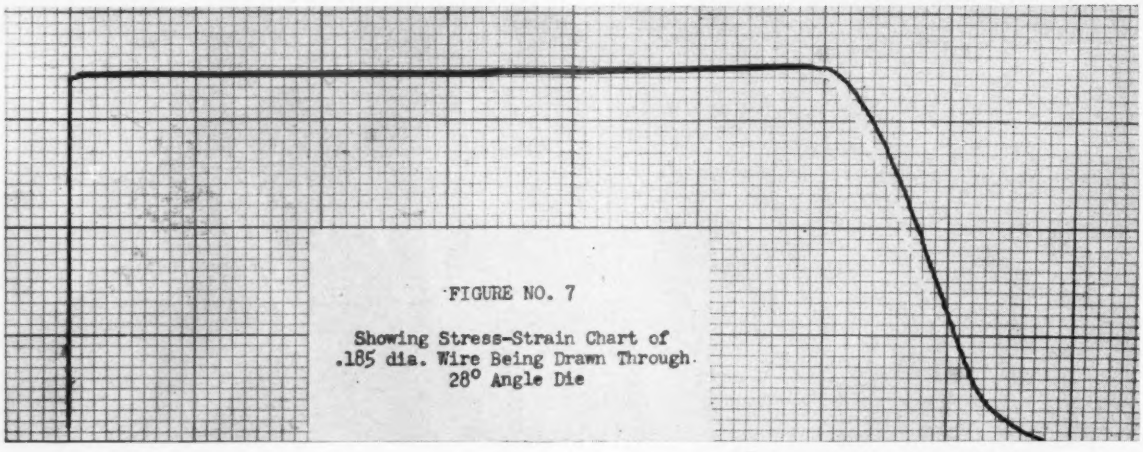


FIGURE NO. 7

Showing Stress-Strain Chart of .185 dia. Wire Being Drawn Through 28° Angle Die

Abscissa 1″ = 1% in 10″
Ordinate 1″ = 200 lbs.

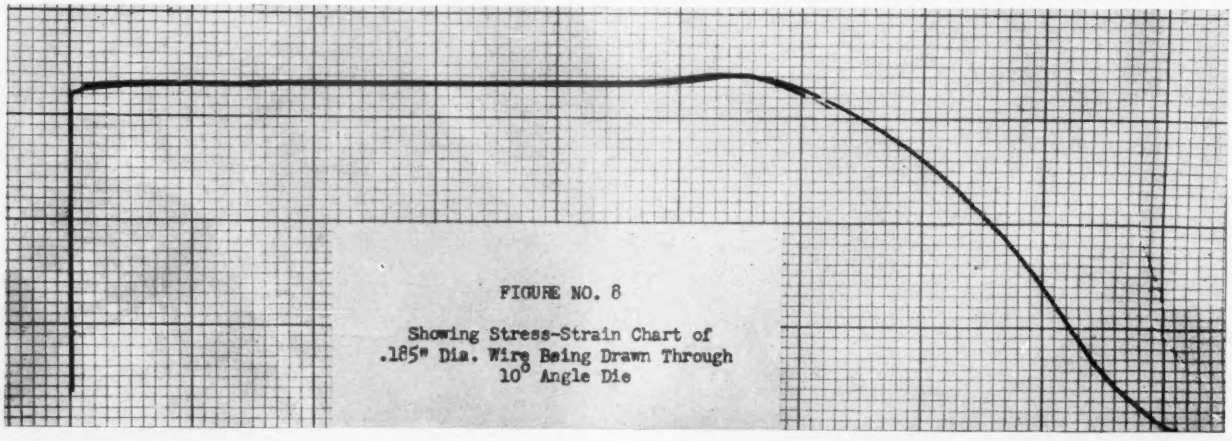


FIGURE NO. 8

Showing Stress-Strain Chart of .185" Dia. Wire Being Drawn Through 10° Angle Die

Abscissa 1″ = 1% in 10″
Ordinate 1″ = 200 lbs.

10% from a starting size of about .190" of both annealed and hard wire of low carbon basic steel, as well as from patented wire of the same size of .40-.45 Carbon; and .60-.65 Carbon. We have not shown these data here since the results are not inconsistent with the results illustrated, although the individual tests varied more between themselves due to the higher speed of drawing used and the somewhat greater lengths of wire involved. Even in these cases, however, the precaution was taken of obtaining the properties of the original starting wire at the same speed that we drew the wire. This limited our speed in all cases to just a few inches per minute.

WE have found in this test that the effect of varying degrees of entrance angle on the die pull and hence the power required to draw wire is not appreciable over a considerable range of angles; the exact limits of this angular range vary with the degree of reduction and the coefficient of friction. The latter increases with the die angle. For instance, with well polished dies and a dead soft annealed low carbon wire we found a difference in die pull from an angle of 28° down to a low, at an angle of 8°, of only about 6%. At 45°, however, the pull was about 15% higher and at 6° about 42% higher than the low point which occurred at about 8°. In general, however, the evidence points towards the use of smallest angle possible before the die pull starts to increase rapidly due to friction.

✦ ✦ ✦

IN closing, I wish to thank the officials of the American Steel & Wire Company for permission to present this paper. Also, I wish to acknowledge the good services and general assistance of our Research Department in carrying out these tests. Acknowledgment should also be given to past investigators of this subject, some of whose reports I have read.

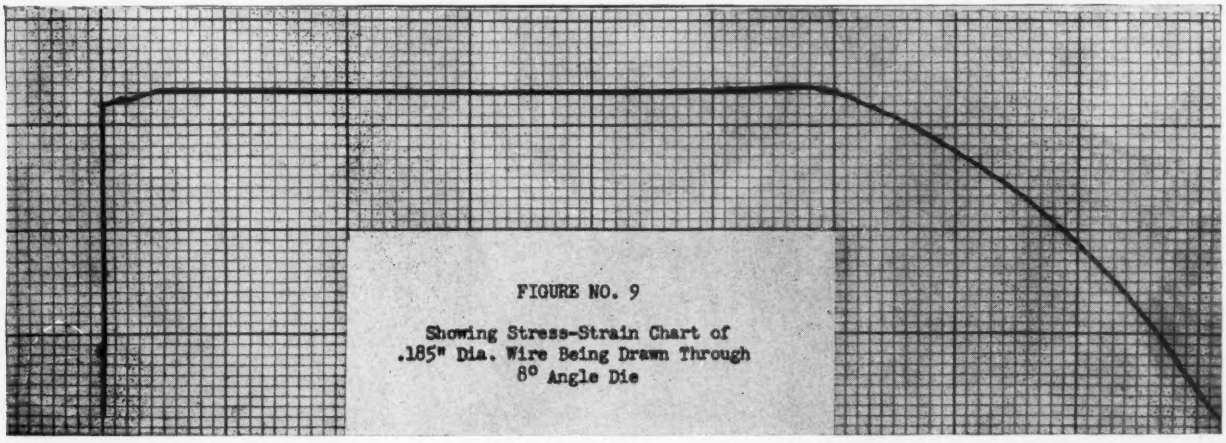


FIGURE NO. 9

Showing Stress-Strain Chart of .185" Dia. Wire Being Drawn Through 8° Angle Die

Abscissa 1" = 1% in 10"
Ordinate 1" = 200 lbs.

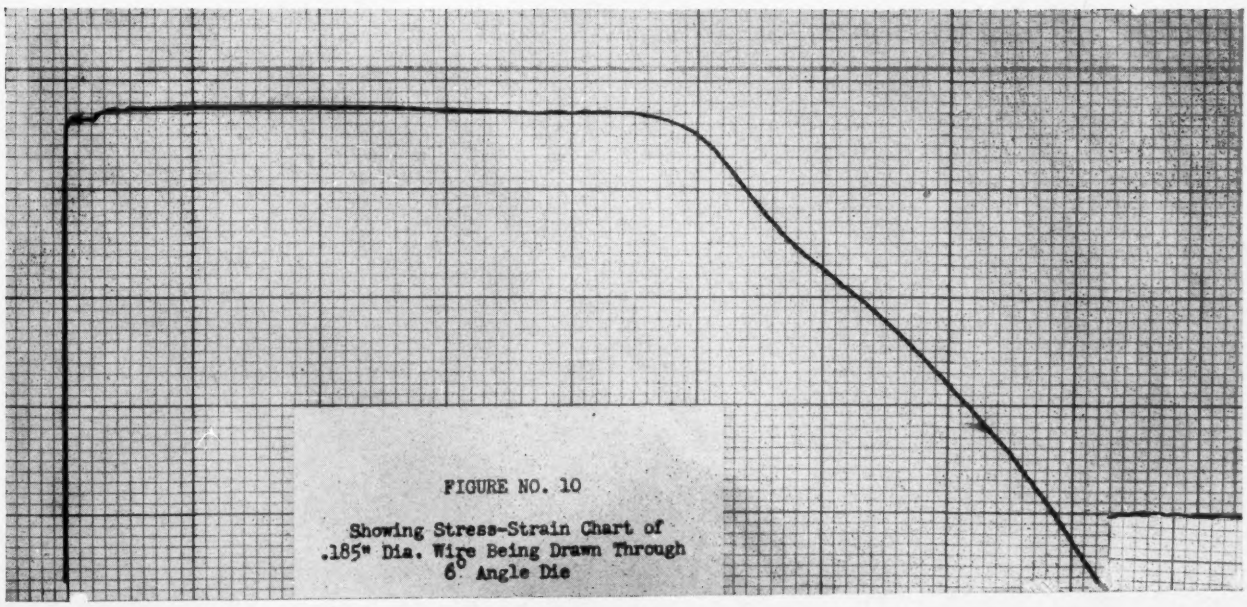


FIGURE NO. 10

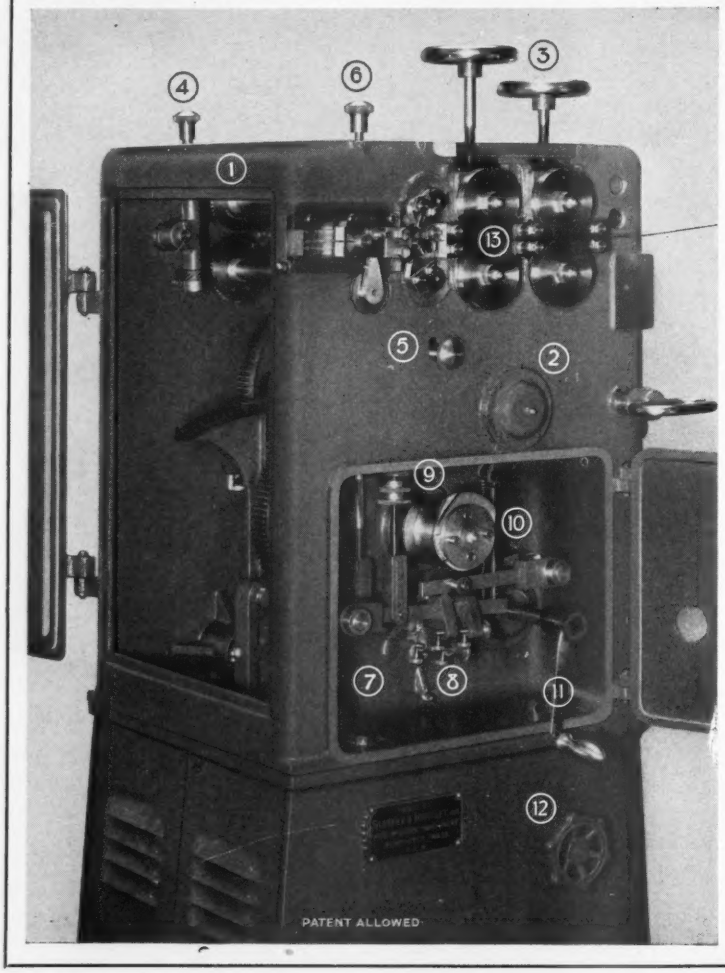
Showing Stress-Strain Chart of .185" Dia. Wire Being Drawn Through 6° Angle Die

Abscissa 1" = 1% in 10"
Ordinate 1" = 200 lbs.

# *13 Points of Superiority*

## *in*

## *No. 1 Universal Spring Coiler*




**1-** One piece cast iron housing for rigidity and perfect alignment.

**2-** Ball Bearing construction throughout on all rotating shafts.

**3-** **Convenient Controls—** Individual pressure control for each pair feed rolls.

**4-** Individual simple adjustment for cutter alignment, easily adjusted from upper to lower cutter.

**5-** Pitch and

**6-** Diameter control readily accessible.

**7-** Pitch and Diameter Cam control located in recess in front housing.

**8-** Rapid and micrometer adjustment of compound blocks facilitates set-up time.

**9-** Pitch stop conveniently located and quickly adjusted.

**10-** Combination cam hub for pitch and diameter cams, completely removable from machine.

Both pitch and diameter cams may be shaped and timed on the cam hub for special springs and the entire unit removed from the machine, thus reducing set-up time. Additional cams and hubs can be applied for this purpose.

One piece solid cams can be used on this removable cam hub.

**11-** Removable ratchet-type crank for set-up purposes only. Removed during operation.

**12-** Motor or Pulley Drive as required with variable Speed Transmission for production range if desired.

**13-** Tooling interchangeable with previous Sleeper & Hartley models.

***No. 1 Universal Spring Coiler***

*Segment Type*

*48" Model* *Series 666*

*Wire Range .018" to .080"*

**INCREASED CAPACITY**

Compound gearing for 96" feed if desired.

**Other Improved Features—**

Morse Free Wheeling Clutch for high-speed accuracy. Morse Free Wheeling Recoil Clutch, as extra equipment, if desired.

Single cutter operation.

Wear free diameter slide connection.

# SLEEPER & HARTLEY, Incorporated

DESIGNERS AND BUILDERS

**Worcester, Massachusetts, U. S. A.**

# The Navy and The Wire Industry

By Captain Augustus J. Wellings, U.S.N.
Office of Procurement and Material, Navy Department,
Washington, D. C.

Address Given
Before The
Members of The Wire Association
Chicago, Illinois
October 20, 1943

TO be here today with you members of the Wire Association is truly an honor and an opportunity to give you some idea of the Navy Inspection Service.

✦ ✦ ✦

YOUR secretary, **Mr. Richard Brown,** suggested that I give you some idea of how important wire and wire products are to the Navy. Well, from the numerous contacts you have had with priorities you must already realize you are indispensable to the Navy.

✦ ✦ ✦

WE could not even lay the keels of our ships if wire were not used on the ship way cranes. To fabricate our ships would be impossible without the wire from which rivets and welding rods are made. Our planes could not be built if you did not supply the wire for the millions of rivets required. To operate our ships and planes, wires and wire products are a vital part. Where would we be without power, lighting and communication lines, control cables of all types, stays, shrouds, springs for safety valves and other mechanisms on engines and guns. In addition you must give consideration to the wire and wire products used by our Seabees. They set up our Navy bases all over the world. It may be an airfield with its hangars and workshops; a hospital, a recreation center, or docks with supply warehouses and other facilities necessary for the operation of Navy ships in distant waters. Truly the material you furnish is indispensable to us and without it we could not construct, operate, or maintain your Navy.

ALL the material used by the Navy must meet certain physical and chemical requirements. To check the material and make certain it meets the requirements is the function of the Navy Inspection Service. The amount of material we are inspecting today is a figure that seemed impossible only a short while ago.

✦ ✦ ✦

AS a result we have had to make large increases in our inspection forces. You will find them operating in every city and town in the United States. Peace time routine has been supplanted by our war time schedule of twenty-four hour a day service seven days a week. As our work load began to increase it became apparent that the manufacturers had other problems on which they needed help in order to meet Navy requirements. The inspection service covering all the country and having contacts with the manufacturers is the logical agency to which they turned. Now the Inspection Service is able to assist you with your CMP requirements and in cases where necessary acts as link between you and the Cognizant Technical Bureau in the Navy Department. They also can give you help in obtaining some material or a piece of machinery in a hurry. They can assist with your manning tables and replacement schedules, checking V loan requirements, etc.

CAPTAIN AUGUSTUS J. WELLINGS

**A native of Boston, is a graduate of the U. S. Naval Academy, Annapolis, class of 1920. After sea experience, he completed extensive post-graduate courses in ordnance engineering at the Naval Academy, Massachusetts Institute of Technology, and Columbia University. He later served as Assistant Ordnance Officer, Navy Yard, New York; Gunnery Officer on the U. S. S. California; Officer-in-Charge, Metallurgical nad Testing Division of Naval Gun Factory, Washington, D. C.; Commanding Officer of the U. S. S. Arctic, and Inspector of Naval Material, Bethlehem, Pa. Captain Wellings is now Director of Inspection Administration in the Office of Procurement and Material, Washington, D. C.**

✦ ✦ ✦

THEY take pride in giving prompt inspection, shipping instructions, certifying invoices, and getting out reports on material shipped. These items are important because they close out a business deal quickly and you get paid for material shortly after it is delivered.

✦ ✦ ✦

THE chief mission of the Navy and all our armed forces is to win the war. In addition, all hands are doing their utmost to win the war in the shortest period of time with a minimum loss of life to our fighting forces.

✦ ✦ ✦

TO accomplish this the Navy must have a large amount of material quickly in order to maintain our various schedules. Up to the present time your performance has been on the whole excellent. A short review of what has been accomplished is as follows:

**U. S. NAVY LOSSES**
**December 15, 1943**

| COMBATANT VESSELS | | SPECIAL TYPES AND AUXILIARIES | 59 |
|---|---|---|---|
| Battleships | 1 | | |
| Aircraft Carriers | 4 | | |
| Escort Carriers | 1 | | |
| Heavy Cruisers | 6 | | |
| Light Cruisers | 3 | GRAND TOTAL | 128 vessels |
| Destroyers | 39 | | |
| Submarines | 15 | | |
| | 69 | | |

**JAPANESE LOSSES**
**December 15, 1943**
**INFLICTED BY U. S. SUBMARINES**
**(Up-to-date, according to the latest available information)**

| | Sunk | Probably Sunk | Damaged | Totals |
|---|---|---|---|---|
| **COMBATANT SHIPS** | | | | |
| Battleships | 0 | 0 | 0 | 0 |
| Aircraft Carriers | 0 | 1 | 2 | 3 |
| Cruisers | 3 | 2 | 5 | 10 |
| Destroyers | 22 | 5 | 6 | 33 |
| Submarines | 0 | 0 | 0 | 0 |
| Tenders | 2 | 1 | 0 | 3 |
| Others | 13 | 1 | 0 | 14 |
| Totals | 40 | 10 | 13 | 63 |
| **NON-COMBATANT SHIPS** | | | | |
| Fleet Tankers | 39 | 2 | 17 | 58 |
| Transports | 32 | 5 | 8 | 45 |
| Cargo and Supply | 226 | 17 | 71 | 314 |
| Miscellaneous | 29 | 2 | 5 | 36 |
| Totals | 326 | 26 | 101 | 453 |
| Total Ships of all types | 366 | 36 | 114 | 516 |

IN July, 1940, the Navy received five newly completed vessels; in June, 1943, almost 1,200.

✦ ✦ ✦

IN JULY, 1940, the Navy received 25 new airplanes; in June, 1943, almost 2,000.

✦ ✦ ✦

BETWEEN those two dates the Navy built 2,200,000 tons of ships. It added to its air arm 23,000 planes. It completed $6,500,000,000 of shore facilities.

✦ ✦ ✦

THREE years ago, when the defense program began, the Navy had a fleet of 1,076 vessels displacing 1,875,000 tons. Of this fleet, 383 vessels were warships: battleships, carriers, cruisers, destroyers, submarines. The weight of this fighting fleet was 1,313,000 tons.

✦ ✦ ✦

DURING the intervening three years, the Navy has lost 58 warships: A battleship, four carriers, nine cruisers, 32 destroyers, 12 submarines. It has transferred to other nations or converted into non-combat vessels 129 other warships. In all, it has lost or given up 484,521 tons of fighting ships—a small Navy in itself.

✦ ✦ ✦

BUT at the end of three years the United States has the mightiest surface fleet in world history. Against the 1,076 vessels of three years ago the Navy now has 14,072. Their combined tonnage is almost 5 million tons against 1,875,000 tons for the fleet of mid-1940.

✦ ✦ ✦

IN the new fleet the Navy, despite its losses, has 613 warships compared with 383 three years ago. Their tonnage — 2,217,982 tons—exceeds that of the 1940 fighting ships by 70 per cent.

✦ ✦ ✦

ON July 1, 1940, the Navy air arm consisted of 1,744 planes of which 1,197 were fighters and bombers.

✦ ✦ ✦

SINCE that time the Navy has lost or written off as obsolete 6,800 planes. It has transferred 2,100 to other agencies. The Navy air arm of mid-1940 has been erased more than five-times over.

✦ ✦ ✦

BUT the United States now has the most powerful Naval Air Force in the world. Where there were 1,744 naval planes three years ago, on July 31, 1943, there were 18,269, a ten-fold net increase.

✦ ✦ ✦

YOU men delivered the goods and contributed your share to make the above achievements possible. You deserve credit for your performance and I am happy to give you our Navy's special signal for outstanding performance — "well done—members of the Wire Association."

✦ ✦ ✦

FROM time to time as the strategic situation changes we may change our schedules and programs. You will have to bear with us on these occasions and shift over to meet our new requirements as quickly as possible. Just as a football team shifts its general method of play each week to meet the strong points of its new opponent, so the Navy must shift its general plans to meet the enemies' strong points as they develop.

✦ ✦ ✦

THE stakes of this war are big ones. Whether this country is to exist as we know it or be a puppet in the hands of Germany and Japan depends on the outcome of our present struggle. Every day new graves are dug on foreign soil for those who have given up their lives in order that we may live here according to our standards. While our percentage losses may be small, every loss is a 100% loss to that man's family. The Navy has a great appreciation of the value of your son's, brother's, or relative's life and we strive by every means not to lose a life, but if lives are lost, we want to make the enemy pay dearly for them.

✦ ✦ ✦

THE men at the fighting front work all hours of the day and night, the conditions under which they work are difficult and trying

(*Please turn to Page 82*)

# Cellulose Acetate Butyrate Tape As Primary Insulation for Wire and Cables

By H. E. Allen,
Manager, Industrial Sales,
The Dobeckmun Company, Cleveland, Ohio.

This paper was presented before the technical session of the Wire Association Convention held on October 21st, 1943 at the LaSalle Hotel, Chicago, Illinois. ✦ ✦

QUITE obviously in a paper of this kind it would be impossible to cover all materials available in tape form suitable for wire insulation. Therefore, we will confine our discussion to Cellulose Acetate Butyrate, a product of The Eastman Kodak Company, which is also being sold in converted form under the trade name, "LEXEL" by The Dobeckmun Company.

✦ ✦ ✦

WHILE it is the purpose of this article to stick to a delineation of the properties of a synthetic i.e. aceto-butyrate, it might not be amiss to mention others in a general way but without making any odious comparisons.

✦ ✦ ✦

I FOR one quite agree with Mr. Lunsford of the Bureau of ships, Navy Department when he says, "There is no material which of itself is either 'good' or 'bad' per se. It is relatively good or relatively bad, as the particular use to which it is put makes it so."

✦ ✦ ✦

CERTAINLY, Acetates, Aceto-Butyrate, Ethyl, Cellulose, Synthetic Rubbers and Vinyls are worthy of careful investigation as electrical insulation.

✦ ✦ ✦

MOST synthetics are inherently antipathetic to water and herein lies their insulation value. Surely, a material that will stop water either in the aqueous or moisture phase is preferable to one that will not.

✦ ✦ ✦

LATER on in this article I will refer to the peculiar property of aceto-butyrate as regards moisture absorption and hope to have some charts available for distribution.

✦ ✦ ✦

SUFFICE to say that the actual service requirements of the Army, Navy, Air Corps or Signal Corps will determine standards that an insulation material must meet and having met those standards by scientific test, it follows that the type or name of a material is of secondary importance.

✦ ✦ ✦

THE data presented in this paper is for the most part a result of Eastman's research on the basic material, although reference will be made to tests conducted in laboratories of several manufacturers.

✦ ✦ ✦

I WISH to acknowledge the assistance of **Mr. Harold Crouch** and **Mr. L. L. McGrady** of Eastman, as well as various members of our organization in the preparation and checking of this data and statements contained herein.

✦ ✦ ✦

CELLULOSE Acetate Butyrate is a cast plastic sheet available in thicknesses from .0005 to .0016 inches and in widths from ⅛" to 40". In laminated form it is currently available in a thickness of .0032 +, this being a lamination of two .0016" films. For simplification, we will refer to these sizes as #160 and #320.

EITHER size can be supplied with a vinyl acetate mixed ester opaque white coating. The purpose of this coating is twofold; to serve as a visual control of the first serving on the conductor and also to facilitate the sealing of the laps. This can be accomplished either by means of heat or solvent action. The temperature of the drying ovens (around 200° F.) is usually sufficient to produce this result, although a positive check is to expose the coils of finished wire in an oven at 225° F. for two hours.

✦ ✦ ✦

THE film without the coating, being a thermoplastic, has no definite melting point. At temperatures above 350° F. it begins to soften rapidly. However, at this temperature a 1" tape of #160 film will readily support 5 gm. Therefore, for wire insulation it should be satisfactory, at least up to this temperature and possibly higher. Chemically, the material is stable up to much higher temperatures.

✦ ✦ ✦

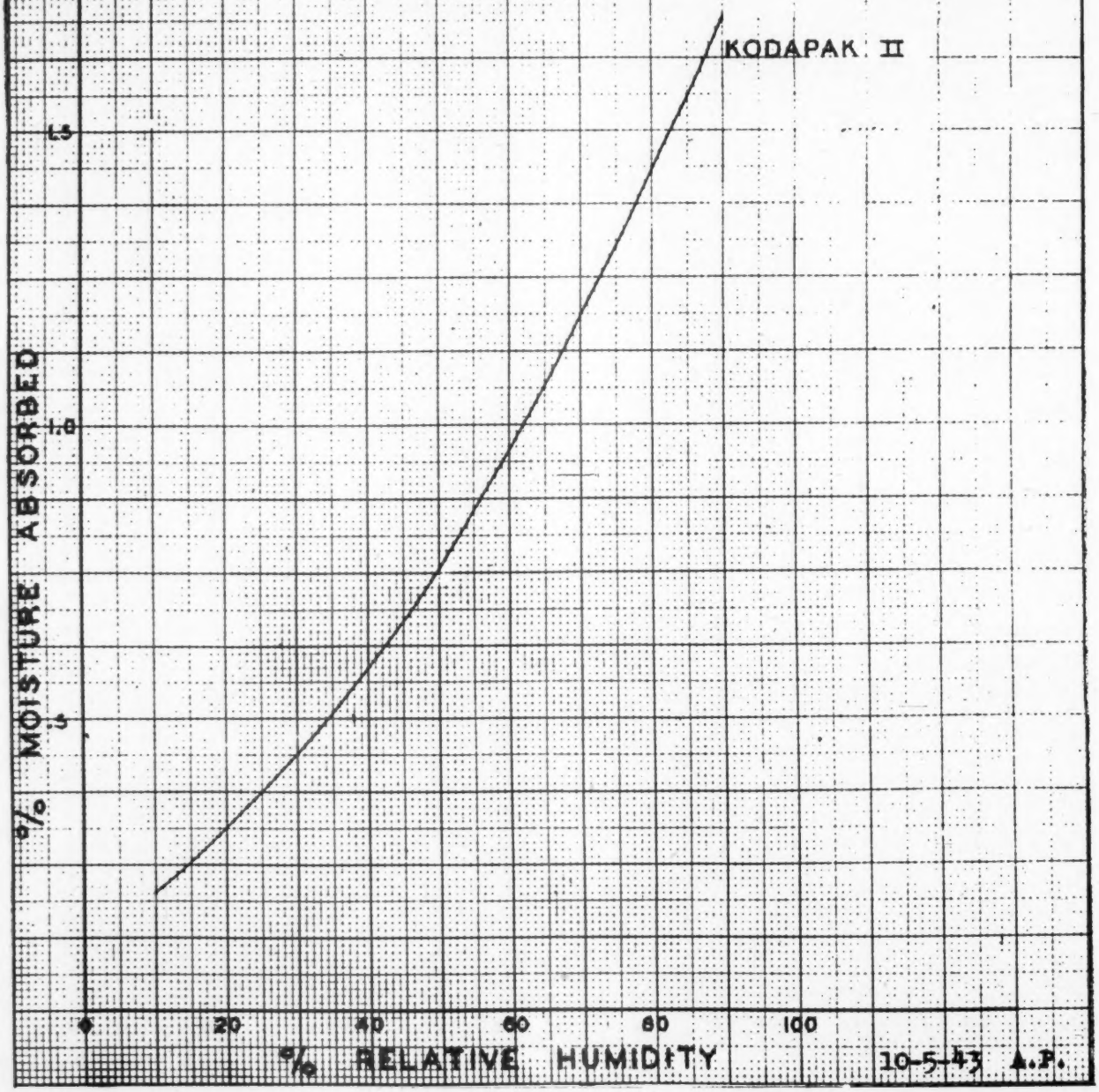
THIS particular plastic has very low moisture absorption. In equilibrium with 20% R.H. it takes up only .4% of its weight in moisture; while at 80% R.H. it takes up 1.6%. Extensive tests, however, indicate that this moisture is present in such a way that it does not materially affect the insulation value of the film.

✦ ✦ ✦

WHAT this means can better be expressed in terms of insulation resistance and dielectric breakdown under conditions such as those outlined in Air Corps

# MOISTURE ABSORPTION OF KODAPAK II

METHOD - Samples were conditioned for 24 hours, placed in weighed weighing bottles, then weighed. They were then evacuated for 16 hours at a pressure of .020 mm. and again weighed. The loss in weight was calculated to percentage of moisture absorbed.



Spec. AN-JC-48 A for aircraft wire and Spec. 71-1677 for radio and instrument hook-up wire.

✦ ✦ ✦

ACETO-BUTYRATE tape has been used to insulate wire in gauges #00 to #22 using a wall thickness of 4 to 6 mils for the smaller sizes and 10 to 20 mils for the larger sizes.

✦ ✦ ✦

THIS primary insulation is usually covered with a braid of rayon, silk, cotton or glass and then given several coats of a lacquer, preferably of a flame-retardant type. It is during this operation that the thermo-setting or sealing action takes place due to a fortuitous combination of pressure, heat and solvent action.

✦ ✦ ✦

THE insulation resistance of wire having cellulose acetate butyrate as primary insulation, and of proper construction, is generally higher than most other insulating materials in common use. This is particularly true after the life cycle which consists of bending the wire around mandrels of a specified size and exposing at 120° C. for five days. After cooling to room temperature, the wires are straightened and then bent again in the opposite direction. After this, comes immersion in distilled water for 20 hours, followed by 5 hours in salt water.

✦ ✦ ✦

THE specification also includes bending around specified mandrels at a temperature of minus 50° C. After this treatment, the sample is immersed in water and the insulation resistance measured.

✦ ✦ ✦

AT the conclusion of all of these tests the wire is tested for voltage breakdown. Wire properly constructed with acetate butyrate tape has shown excellent results. These values for the most part run in the range of 18 to 22 M volts on #8 gauge wire.

✦ ✦ ✦

RELATIVE to diameters, there appears to be a definite advantage in tape-served insulation. Tests have indicated that in many instances tape walls of half the thickness of extruded walls are satisfactory. This saving of material, plus improved production speeds and freedom from defective wire would seem to indicate favorable costs, at the same time promising absolute assurance that there is a uniform amount of insulation around the conductor. In other words, it is "center-sealed."

✦ ✦ ✦

IT can readily be seen how important this saving in space and weight can be in equipment for use in airplanes, warships and portable apparatus.

✦ ✦ ✦

TESTS have recently been run on cables in the construction of which Cellulose Acetate Butyrate has been used as an alternative material to varnished cambric.

✦ ✦ ✦

THE results are encouraging and no doubt a specification will soon be written making Cellulose Acetate Butyrate acceptable for this use.

✦ ✦ ✦

THE dielectric B.D. per mil of thickness is somewhat higher than V.C. and the insulation resistance also shows a marked improvement, especially under conditions of higher humidity and after immersion in water.

MANY millions of feet of wire have been supplied under Signal Corps Spec. 71-1677 using Cellulose Acetate Butyrate as primary insulation. While it is too soon to have extensive test data under the new Spec. C75/465, we have no doubt as to the material meeting this Spec. in every particular. ✦ ✦ ✦

IT is interesting to note that one manufacturer of Radar and communications wire has established his own Spec. on this tape. Each shipment is carefully checked to make sure it complies. Some of the salient features are:

**Minimum Average Insulation Resistance 50,000 Megohms.**

**Minimum Single Reading 30,000 Megohms.**

**Chloride Content: Maximum .020% reported as Chlorine.**

✦ ✦ ✦

THE tests for insulation resistance require the pieces to be maintained at a relative humidity of 90½% — ½% and at a temperature 87° F. ± 2° F. for 48 hours. ✦ ✦ ✦

THIS test is run in accordance with ASTM Standard Method D-257-38 using a potential of 100 volts ± 10 volts.

✦ ✦ ✦

TESTS conducted in the laboratories of The Eastman Kodak Company indicate the physical and electrical properties of the material itself and are shown in Table I.

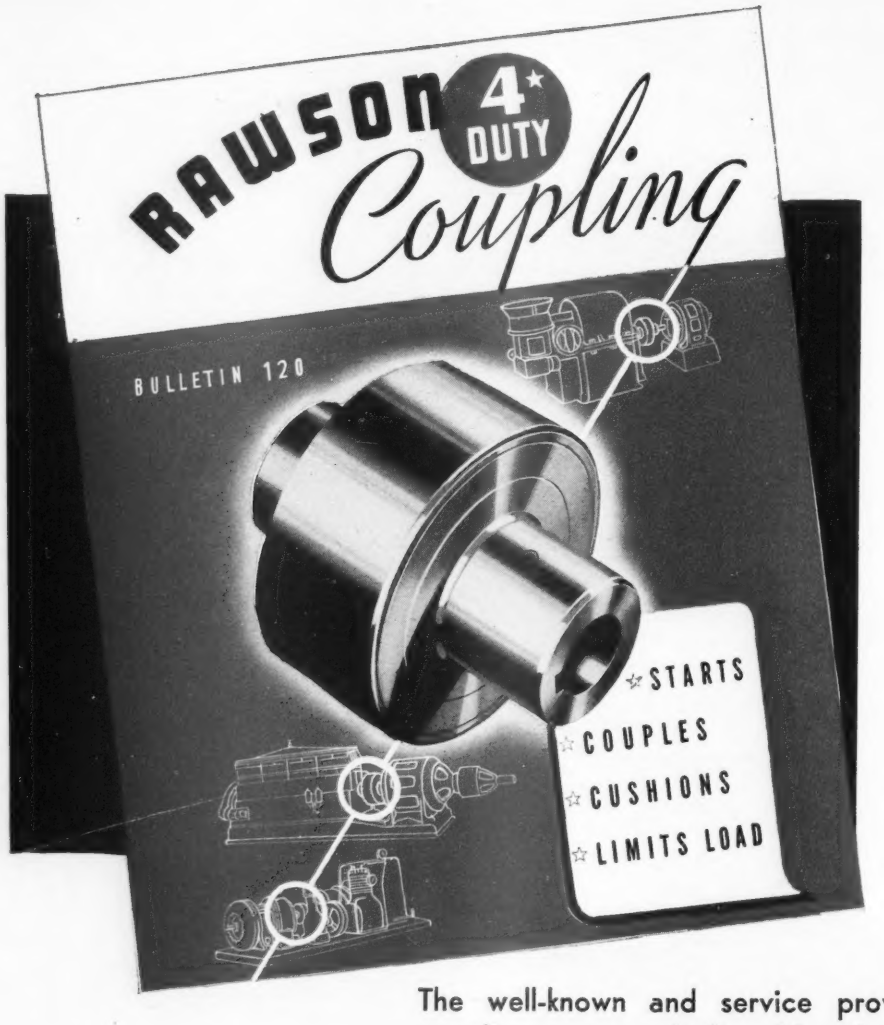
(*Please turn to Page 83*)

**TABLE I**

**PROPERTIES OF KODAPAK II**

| | | |
|---|---|---|
| **PHYSICAL** | | |
| **Specific Gravity** | | **1.20** |
| **% Elongation—L.** | | **Not less than 40% in** |
| **—W.** | | **both directions.** |
| **Tensile Strength (kg.)—L.** | | **3.5** |
| **15 mm x .0016" —W.** | | **3.0** |
| **Moisture Transmission—(mg/cm²/hr.)** | | **1.00** |
| **Oven Shrinkage—130° F.—1 week** | | **.5%** |
| **Moisture Absorption—20% R. H.** | | **.40% by weight** |
| **—40% " "** | | **.55% " "** |
| **—60% " "** | | **.90% " "** |
| **—80% " "** | | **1.4 % " "** |
| **—95% " "** | | **1.7 % " "** |
| **ELECTRICAL** | | |
| **Voltage Breakdown—Short time (V./mil)—** | **50° F.** | **4,300** |
| | **0° F.** | **4.000** |
| | **70° F.** | **3,500** |
| | **212° F.** | **3,000** |
| | **270° F.** | **2,000** |
| **After soaking in water** | **70° F.** | **3,400** |
| **Dielectric Constant—1,000 cycles** | | **2.5 approx. (May be higher)** |
| **Power Factor—1,000 cycles** | | **1.1%** |

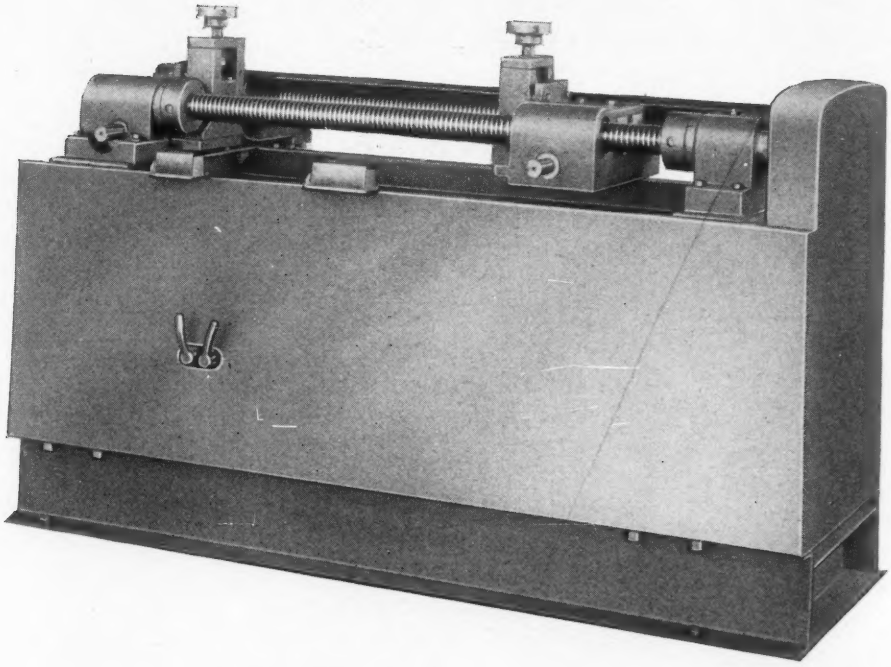
# 2 new Syncro




The well-known and service proved "Rawson" couplings are now built, sold and serviced by the Syncro Machine Company. Future advertisements will provide additional information.

## SYNCRO MACHINE

# products...



## Electric Rod Pointer

The Syncro quality-built Electric Rod Pointers electrically point round or shaped sections of ferrous wire or rod. Standard machines are built to point material from 1/8" diameter to 1" square or equivalent sections. Other sizes built to suit requirements.

**COMPANY** RAHWAY, NEW JERSEY
McCORMICK BLDG. CHICAGO

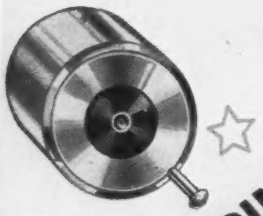
SYNCRO

# FIRTHALOY COLD-HEADING DIES

# WILL SET PEACE-TIME STANDARDS

**War's** demands for higher output and sustained precision in the cold heading of bolts, rivets, etc., have been met effectively by wider adoption of FIRTHALOY Cold-Heading Dies.

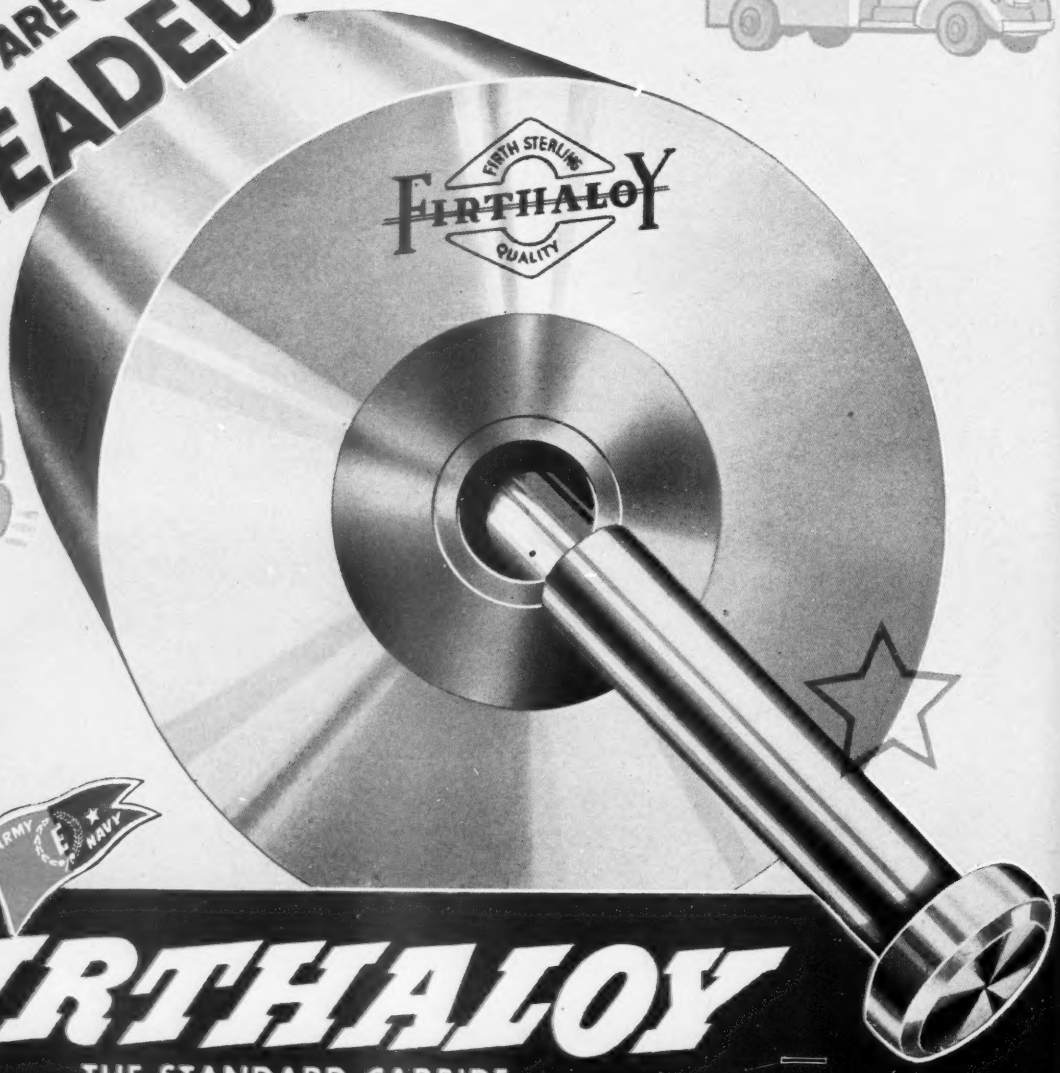
**Peace** will call for even greater use of FIRTHALOY in cold-heading plants, particularly for more economical operation. Farsighted plants are making FIRTHALOY Sintered Carbide an important factor in post-war planning.



**FIRTH-STERLING STEEL COMPANY**

Offices: McKEESPORT, PA. NEW YORK - HARTFORD - PHILADELPHIA - CLEVELAND
DAYTON - DETROIT - CHICAGO - LOS ANGELES

## HEADING ALL MATERIALS THAT ARE COLD HEADED



# FIRTHALOY

THE STANDARD CARBIDE

# WIRE ASSOCIATION PROCEEDINGS

## Meeting, Monday, October 18, 1943 - 2:30 P. M.

Chairman of Meeting

C. A. Litzler, Chief Engineer,

Industrial Oven Engineering Co., Cleveland, Ohio

| | | |
|---|---|---|
| OPENING ADDRESS | Carl E. Johnson | President of the Wire Association |
| PAPER: "Designing Mills for Government Purposes" | Paul M. Mueller, | Revere Copper & Brass Company, Rome, New York |
| PAPER: "Training in Work Simplification" | Allan H. Mogensen, Editorial Staff | "Factory" New York, N. Y. |

### OPENING ADDRESS

**The President:** I am certainly happy to have this privilege again to welcome all of you to the annual convention of the Wire Association.

A year ago at our meeting we were a little bit in doubt as to whether we would have a meeting this year; whether it would interfere with the war effort. But I believe the Wire Association has done its part in promoting the war effort, if we can take the record of the past years as having any meaning.

We had very successful regional meetings at Worcester, and Pittsburgh, and for some of you gentlemen who do not know it as yet, the plans are afoot for a regional meeting on the West Coast, San Francisco, on the 29th of this month.

This convention has been appropriately named the "Wartime Emergency Convention," because we have only one justification for this meeting, and that is to help promote the war effort. It is up to us, in our small way, to help try to win this war. Then if we have time, we can give consideration to such things as, what is going to happen in the post-war period.

We have had a lot of problems dumped in our lap in this past year. It has been a tough year for most of us. A lot of us probably know more than ever before the meaning of such terms as "verification," "hardenability," "decarb," and "machineability.' They mean something to all of us. That is just an example of the type of problems that we are faced with today.

The solution of those problems is immediately affecting the war effort. It is up to us to get together on those problems.

As far as the post-war period is concerned, there is probably no one in this room but what has given consideration to some of the things that are going to happen after the war. We have mulled over things, we have probably designed and thought of things, stuck them away or pigeonholed them for a time when equipment and manpower and materials would be available to put those things into effect.

It is important to talk about those things. When we consider the world trend today, when we think that from the way things are going, we are probably going to be asked to feed the world, to rehabilitate both friends and enemies, we are going to equip them, we are going to give them material with which to do the job, we are going to get together with the entire world, and then turn around and try to compete with them.

We have a serious problem facing us, and the more getting together we do now, the better job we can do later on. A part of the industry has already gotten together, and they are doing a pretty good job of it. It may seem like an advantage to them, this getting together, whether it is or whether it is not is questionable. But we, the management, the sales and metallurgical, the operating, all of us, have to get together and do a whole lot more getting together than we have ever done before if we are going to do this job.

That is the idea of having this convention. In the meetings here we will offer ways and means of getting together and getting some information. The meetings are not going to be the entire solution, but informal get-togethers will be helpful, and you will find among the men attending this convention men that are willing to talk, men who have solved some of the problems that you have not quite solved yet, and you will find among those men probably a solution to your problem.

It just means one thing, that when we level off, we had better be ready to take over. There is a story about the P-38. That lightning-fast ship was delivered to an Army base out on the West Coast. It was a hot ship, everybody knew it, it would go between 700 and 800 miles on a dive, and climb like an elevator. They brought it to this Army base for tests. They put the best pilot they had on that plane to test it.

Well, he ground-maneuvered a bit, went up the runway, and nothing happened. Before he went up they put a recording thing on him, and a bunch of brass hats were out on the field with the mikes on their ears, so they could get a recording, find out a reaction from that pilot on every bit of the trip he was on.

Finally the pilot screwed up enough courage to take off. He cleared the runway, and came down and scooped up, and they didn't hear anything over the phone. He climbed for a great distance, and finally leveled off. Then they heard coming over the microphone what sounded like first a gulp, and then a gasp as if somebody was trying to get his breath. Then they heard this coming over the mike: "Okay, Jesus, from this point on I'll take over." (Laughter)

Now I don't know if Jesus is getting out in the place we're getting to or not, but we're getting to a place where it is going to be necessary for us here in this room to take over some of these things today. The greater advantage we take of the meetings this week, it is going to be that much of an easier job to take over when the time comes.

THERE WAS NO DISCUSSION ON THE PAPERS "DESIGNING MILLS FOR GOVERNMENT PURPOSES" AND "TRAINING IN WORK SIMPLIFICATION"

## Meeting, Tuesday, October 19, 1943 - 9:30 A. M.

Chairman of Meeting

R. B. Whyte, General Superintendent,
Macwhyte Company, Kenosha, Wisconsin

| | | |
|---|---|---|
| PAPER: "Drawing High Speed Rope Wire" | John C. Aiken, Asst. Supt. Wire Mill, | Jones & Laughlin Steel Corp., Aliquippa, Penna. |
| PAPER: "A Graphical Solution of Wire Mill Mathematical Problems" | E. J. Crum, Foreman, Bethanizing & Galvanizing Depts., | Bethlehem Steel Company, Sparrows Point, Maryland |

### PAPER: "DRAWING HIGH SPEED ROPE WIRE"

Mr. John C. Aiken presented the above paper.

**The Chairman:** I think that is a good grasp of the paper on the drawing of wire for wire rope. We will now throw the meeting open to questions.

**A Member:** I would like to know how hot the wire can get on a wire drawing block before the torsions are spoiled.

**Mr. Aiken:** I don't believe I can answer that in the degree of temperature. In fact, I think I have written to Kenneth Lewis and some others about it. It's an awfully hard thing to measure the temperature of wire emerging from a die. About all I can say on that is when the wire is going around the block and coming near the top of the block, ready to go over to your next die, it is easily touched by the hand and it is quite a low temperature.

**A Member:** I can answer that question to some extent. We have tried to measure the temperature of wire as it comes from the wire drawing block, running it through a small pool of mercury. Although that isn't too accurate, it's probably too low, it does of course, rise and fall as the temperature of the wire rises and falls. If you measure your temperature that way, you'll get temperatures anywhere from 350 degrees Fahrenheit up to 650 degrees Fahrenheit. If the temperature is below 450 degrees, your torsions will be pretty good. If you get it up around 650, they're rotten. That will give you some idea.

**A Member:** Doesn't the time element enter into this thing?

**Mr. Aiken:** I might ask you, is that mercury temperature determined right at the exit end of the die?

**A Member:** Yes, the mercury will be within three or four inches of the die. Of course, the temperature falls pretty rapidly when you come out of the die, so there is a distribution of temperature that takes place pretty quickly.

**Mr. Aiken:** After you get three or four, or a half a dozen wraps around the water cooled block, that temperature is practically dissipated.

**A Member:** That's right.

**Member:** Do you have any trouble with torsions at .091 drawing at the 86% reduction area?

**Mr. Aiken:** No, we haven't had any trouble. We hold to a standard of thirty-three torsions per hundred diameters, and we get along very well. There is a very slight amount of rejection—it's considerably less than one per cent over a long period of time. That covers practically all gages.

**Member:** Do you get a fracture?

**Mr. Aiken:** We get a pretty clean fracture, and not a bumpy torsion.

**Member:** What do you consider the maximum reduction of area from the last patenting point for a good practice? In other words, where would you feel safe in putting in the higher carbon in order to reduce the large patenting point? Would you say 85%, or what is it? Or don't you have any?

**Mr. Aiken:** The example I took on .016 wire was 90% reduction from .051. That's just about as far as we think we ought to go. That's about the limit we take on dry drawn wire.

**Member:** I would like to ask if the speaker thinks the condition is exactly the same on the slip and non-slip machines. Would you see a difference in torsions?

**Mr. Aiken:** I don't know whether I can answer that, except by saying that I know all machines have some tendency to slip. I believe that on one of the water cooled machines we're running, the manufacturer allowed for about three per cent slip. If you mean a lot greater amount of slip than that, then I don't believe that we try to draw rope wire on a machine with a high percentage of slip. I'm running around your question somewhat, maybe, but that's the best way I can answer it.

**Member:** I would like to ask another question. When you're shooting for a certain tensile strength in the finished wire and calculate that you will start with another strength in your patented wire, how do you go about getting that patented strength? In other words, you have several factors that would affect it. If it doesn't start out right, you won't finish up right. How do you make sure that you get the required patented tensile strength?

**Mr. Aiken:** By selection of the chemical constituents of the steel, of course, and work through a hardness factor which is simply a combination of carbon and manganese which we add together and divide by a constant that I have forgotten at the moment. If the hardness factor is low on that chemical combination, then the patented size will have to be increased.

**Member:** Would it give you accurate results?

**Mr. Aiken:** Yes, we find it works out very accurately.

**Member:** I believe that factor is calculated at one-third of the manganese plus the carbon, and it keeps a definite factor between 86 and 100. But for each one of those factors we have a definite reduction for the total pickup of tensile strength.

**Mr. Aiken:** We have built up experience tables over a long period of time, so that we are able to tell from the hard-

ness factor just about where we will hit on tensile strength for a given analysis and draft. If the steel is .72 carbon and .80 manganese, for instance, we might have to do a little juggling as compared with .67 carbon and .60 manganese on the very bottom of the grade range. Here again we resort to our hardness factor.

**Member:** That matter brings us to the way we have to make our wire now, compared to the way we used to make it. We all know that we have nickel, chrome, tungsten and molybdenum steels, and they're getting worse. Of course the people who supply our rods tell us that they have no effect whatever. We used to be able to patent the rod, arriving at a certain tensile strength, and then we had a formula, as some of you gentlemen have told us, by which we would know what size to use and get a finished size. That worked out very well. It was quite uniform.

Then about the last two years these other chemical elements started to pile up on us, and we found that the formula was absolutely no good because we didn't know what to do with various amounts of nickel, chrome, copper, molybdenum, and I'd probably say, "and so on," because we'd probably get some more.

So we have had to come back to the old practice of patenting a rod, getting the tensile, and in spite of that running a shoestring to some convenient size that we could always use for either plow, or improved plow or for galvanizing. That is the only way to do it, and if anybody else knows another way I'd like to know it, because I sure want to learn.

**Mr. Aiken:** I think we are rather fortunate in our company in that respect, in that, up to date we have had no alloy contaminations, and we can still pretty well stick to our steel formulas. Of course, when we started in the rope wire game we ran a shoestring on everything, regardless of what it was, even down into mild plow grade. We don't run very many shoestrings on the lower carbon grades now, but we still have to run them on the higher carbon grades.

**Member:** I was wondering, how close do you come to the rod size before you actually go over the rod size? I ask this question from an economic point of view. I don't know how your rod mill rolls as to off size, whether you roll a normal .250 or whether you roll a heavy .250 rod, but I wanted the economics of that. Do you draw your cleaned and lime coated rod first, and then go back to your patenting setup? Why not start right with your rod with the correct hardenability and take it right down to the finished size?

**Mr. Aiken:** We believe, in our mill, that rods rolled for rope wire, no matter how good they are with respect to size, are still not good enough to be drawn direct to rope wire. That is about the only answer I can give you on that. A lot of people, I believe, make rope wire directly from the rod. We still feel that we must break down to a wire size before the last drafting, or if it's a larger sized rope wire the first drafting, before we go on. We don't think we get uniformity in tensile or uniformity in torsion, from a hot rolled rod, which at best isn't very uniform.

**Member:** In connection with that, do you draw green down to the wire size, or do you patent the rod?

**Mr. Aiken:** In the .091 example we would draw green to .244. In the .016 example we patented the rod first and then took a fairly heavy reduction because we had a long way to go. But where it is only one draft from the rod to the patenting size, we will take that draft green and try to roll a rod so the draft isn't very heavy.

**Member:** Mr. Aiken, on your .016 wire you used 90% draft from the last patenting. Now is that wet or dry drawing?

**Mr. Aiken:** That's dry drawing.

**Member:** I would like to know if you have determined how light a draft you could draw wire without getting any detrimental effects? I mean draft per hole. Is there a minimum amount of draft per hole you can give?

**Mr. Aiken:** No, I don't know of any minimum draft per hole. If you hold your wire stiff and steady so that it won't wobble or float through your die and providing you take enough of those light drafts to get your total reduction, I do not believe you will have harmed the wire in any way.

**Member:** You have never found any detrimental effects from too light a draft?

**Mr. Aiken:** Not that I know of, and I'm not sure I can remember the figures, but, on a chart in one of the technical books, we are told that, in the range of about 20 to 45% total reduction of area, the torsions are very poor. Below the 20% and above the 45% the torsions are good.

**Member:** I had in mind the detrimental effects that might occur to the wire by some possible internal fracture of some kind, which might show up in some later draft.

**Mr. Aiken:** I don't think wire was ever hurt by light drafting.

**Member:** One other thing, I assume that your drafting is uniform, as it pertains to reduction?

**Mr. Aiken:** Not necessarily. On some machines there is a double deck on the first block or spindle, and from the first draft to the second there may be thirty per cent reduction and the following draft 25%, or you can shade a little bit off, say at the third and fourth draft, and make the last one heavier. Of course, if the draft is heavy in the middle you make the last one light. Now I'm only talking of a few per cent one way or the other, not necessarily a strict twenty-five per cent draft per hole throughout, because you can jump around a bit and not hurt anything. Some people think that a light first draft and a heavy last draft helps the torsions, and some people think it doesn't.

**Member** I would like to ask you something about the life of the dies that you use, and how you determine when the die is supposed to be through.

**Mr. Aiken:** The second part of your question is easier to answer than the first part. I'll take the easy part first. As soon as the wire is out of gage, or has a defect that can easily be determined by sight, or by the micrometer, it is a little bit past time to take that die out. As far as how long a die will last, or how many pounds, or how many feet can drawn through a die before it is gone, I think I would rather send a die man around to see you and let him talk to you, because there are so very many different conditions that enter into the problem such as, cleaning, liming, the analysis, and all other factors.

**Member:** When you lead quench, do you have any trouble with the drafting?

**Mr. Aiken:** Not any more than anybody else. (Laughter)

**The Chairman:** I thought the question was going to come up here, when we got into patenting, as to juggling the temperature of your cooling medium a little bit to get the right tensile strength at the patented point. Has anybody got anything on that? That used to be quite a common practice.

**Member:** We all know that if you find your temperature is off, through your pyrometers, something is wrong with the finish. You take a 24 wire patent, and find that 24 wires are varying anywhere from .010 to .015 across, which one are you going to take as your base to get your patent? Why not fool around with a little extra drafting? That would be my thought along that line, because at no time would you find 24 wires fitting the tensile at every spot. They come from different rods that are rolled at different tensile temperatures.

**The Chairman:** I wanted to know if anybody is still juggling their temperatures to get certain physical strengths, tensile strengths, after the patenting point. That question has been one that has been solved by changing the temperatures.

A question has been brought up about the residuals in steel today. Could you tell us whether or not that has made any difference in your patenting temperatures?

**Mr. Aiken:** We haven't made any changes in the patenting temperatures.

**Member:** I would like to know if it has ever been found necessary to maintain a minimum figure between the patenting, and a reduction in area. For example, if you had some patented wire that you were planning to use on a specific size, was it necesary to give a light draft and repatent? Does that material affect the life of the rope?

**Mr. Aiken:** I don't think I know the answer to that. I will pass that to somebody in the audience.

**Member:** I wonder if Mr. Aiken has had any experience with galvanizing hard-drawn rope wire on some of the larger sizes.

**Mr. Aiken:** Yes, we have had quite a little experience on galvanizing rope wire. We had one particular order, the size of which was .232. We had a lot of difficulty with this order because of breakage. But aside from that order and that item, we haven't had any appreciable trouble at all on galvanized rope wire.

**Member:** Do you find that the torsions are materially lowered after the galvanizing?

**Mr. Aiken:** Yes. I don't think I would say materially lowered, but we expect some torsional drop due to the galvanizing. For instance, on a 33 torsion bright wire, .091 size, we would consider 25 torsions when galvanized as being pretty fair.

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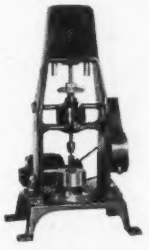

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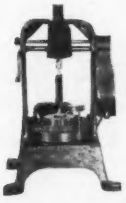

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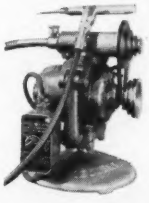

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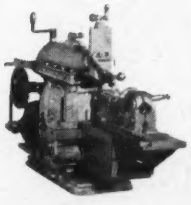

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**Member:** I have had some experience in galvanizing wires, and I remember an instance where we galvanized some wire that had torsions and some that didn't have torsions, that is in the bright wire. I was never able to determine just exactly what happened, whether it was some effect of the low temperature in the galvanizing operation, or some defect that might have been caused by the acid. I thought you might have had some experience along the same line. I never did know what it was about.

**Mr. Aiken:** I don't know that I can answer that as to what would be the cause of such trouble.

**Member:** Would you accept an order for .091 galvanized at a minimum of 25 torsions?

**Mr. Aiken:** As far as I know there are no specifications on torsions for galvanized wire. I wondered if somebody was going to catch me on that.

**Member:** I thought it better be corrected, because the rejects would be pretty high.

**Mr. Aiken:** I might expect to go down to 25, but I'm glad you brought it up, because as far as I know there still aren't any specifications on galvanized rope wire torsions.

**Member:** I heard you mention the fact that residuals affect the various properties. I wonder if any attempt has been made to determine the effect of residuals. For example, the molybdenum, or the copper, or what have you.

**Mr. Aiken:** I'll have to check that one to somebody else.

**The Chairman:** I don't think there is any question but what work has been done on that, but I can't give you the answer. There is no question but what there are some in the audience that have done some work on it.

**Mr. Aiken:** I can say one thing on that. We know that .12% moly will raise just plain hell with the rope wire.

**The Chairman:** Does anyone else have anything on that? I guess the best answer to that is that we don't want the residuals in our rope wire, and we have to do the best we can with them while they are there. I know definitely that they do set up factors, and we have to juggle the carbon content and the manganese to counteract it, but I am not familiar with the figures.

Are there any other questions? If not, I will again thank John for his paper and the discussion. (Applause)

I would like to call Herb Clark to the platform.

**Mr. H. B. Clark:** I hadn't intended to say anything about this until later, but I was talking to Dick Brown, and I think it would be a fine gesture to just pay a passing tribute to one of the original members of the Wire Association, a man with whom I was associated for two years, and who later worked for a competitor of ours.

I refer to Henry Elias, who left us about six months ago. I believe he was a man who contributed as much in an impetuous, enthusiastic sort of way, to the development of the carbide drawing die industry as any man who ever participated in it. Under the circumstances, you can see that about all we can say is that we recognize his passing, and salute him as a good friend, capable, sincere, and an enthusiastic workman. (Applause)

## PAPER: "A GRAPHICAL SOLUTION OF WIRE MILL MATHEMATICAL PROBLEMS"

Mr. E. J. Crum then presented the above named paper.

**The Chairman:** I am sure that we have all had something new for us in this paper. I don't know what kind of questions you're going to ask. It may be that you have in mind some other application of charts of this nature that might be worked out.

**Mr. Crum:** I don't know whether he has taken the machine down or not, but if anyone wants to refer to any particular chart, we can easily do so.

**The Chairman:** Is there anyone that wishes to refer to any particular chart for explanation on the application?

**Member:** I would like to ask Mr. Crum, what method do you use to make a scale four inches long?

**Mr. Crum:** I have covered none of that in my paper, but it is a rather simple thing. The usual method is by projection from another scale. These particular ones were made up by taking a picture of a scale from a twenty-inch slide rule. They were then projected to proper size.

**The Chairman:** Mr. Crum, I haven't read the article yet in "Wire & Wire Products," but do you think that charts could be worked up similar to these from the article—is there enough in the article so that they could begin—

**Mr. Crum:** No. In my paper I have said that I am dealing with the practical application of these charts, and not the construction of them. I think that is a little bit too involved. But I have included an appendix listing books which deal with the subject. Some of them are rather easy to handle. But there really isn't anything in the paper that would help a man in chart construction. I have done my best to make the charts clear by using specific problems that will be of use to you.

**Member:** I have had some experience with making charts myself, but they haven't been in conjunction with wire mill practice. I found that sometimes, especially after you catch on to the method of construction, it doesn't fit a great deal of the time. For the specific purpose I have in mind it took some time to make a chart, and it took four or five hours to do the calculations, and the answer was higher than what you would have obtained with a slide rule. It's quite easy to construct the simpler charts, but when you get more than three or four variables, three or four quantities, you get into a little more advanced stage.

**The Chairman:** Are there any more questions? I think it is rather difficult to get questions on a subject of this kind unles they are specific.

**Member:** I am just wondering if it is possible to obtain these instructions. Are they printed?

**Mr. Crum:** They are not, but I don't really believe it is necessary to have accuracy of that order. On the usual problems that are solved around a wire mill, slide rule accuracy is certainly good enough. And I think charts are much more convenient. Of course, if you're doing a specific job, and you wish to nail the chart up on the wall or put it on a table, where the operators are using it all the time, it would make it a little better to increase the size. They can be enlarged, if you have a good lens.

The point I am trying to bring out through this paper—I don't know whether I have gotten it across—is that we are making a specific chart for a specific job in order to gain accuracy and speed. We need not stick to flat charts. There is no reason why the chart can't be mechanized. It can be put into many forms. You can make a circular slide rule that solves a specific problem. This graphical firing table that I mentioned is a slide rule.

By the way, that slide rule was invented by a young Captain about two and a half years ago. They had been using complicated mathematics and referring to tables and charts, and this Captain, just in self defense, as he puts it, against slow torture, invented the graphical firing table in two hours' time. The graphical firing table has made the difference between an average Artillery, which we had, and the best Artillery in the world. That shows what can be done if you are familiar with the methods of construction.

**The Chairman:** Are there any other questions? If not, the meeting will stand adjourned.

## Meeting, Tuesday, October 19, 1943 - 2:00 P. M.

### Chairman of Meeting

Fred M. Crapo, President,
Indiana Steel & Wire Co., Muncie, Indiana

| | | |
|---|---|---|
| PAPER: "The Use of Lead Base Coatings as a Substitute for Zinc" | C. A. Kellogg, Chief, Dept. Metallurgy & Inspection, | Continental Steel Corp., Kokomo, Indiana |
| PAPER: "Hydrogen Brittleness in Spring Steels" | Rodman R. Tatnall Metallurgical Engineer | Wickwire Spencer Steel Company, Worcester, Mass. |

### PAPER: "THE USE OF LEAD BASE COATINGS AS A SUBSTITUTE FOR ZINC"

**The Chairman:** One of the very interesting things about these meetings is the possibility of asking questions and making comments upon the papers that are read. I think this subject should permit a very considerable amount of discussion. Those who have followed the various outdoor exposure tests over a number of years can now remember how in the early days of those tests, where some of the exposures were quite severe, very quickly the word came back, "Well, the lead coatings are terrible, they are failing and they look bad." As time went on, however, and later certain physical tests were applied to these various specimens, everybody was surprised to find that the lead coatings hadn't failed, and that they were still there.

That thing that fooled many of the observers, namely, this film of rust that, as Mr. Kellogg has told you, will cover almost a square inch from a pin hole that can scarcely be seen with the naked eye, was simply a film that soon disappeared, and the underlying protective lead coating was still there doing its work.

I am sure Mr. Kellogg has had a great amount of experience with the lead coating of sheet and wire as a possible substitute for zinc, and will be very pleased to tell you more in detail what his experience has been, and also any comments that anybody might have who has had experience with lead or lead alloy coating, would be of interest to all of us.

Does somebody have a question that he would like to propose to Mr. Kellogg?

**Member:** I have lead coated a lot of stainless steel and straight nickel alloys using only zinc chloride solution. Why do you have to have any alloy with your lead, why can't you use the pure lead?

**Mr. Kellogg:** I am not familiar with the coating of stainless steel. We have been able to coat low carbon steel with pure lead.

**Member:** I would like to ask what success you have had with coating wire.

**Mr. Kellogg:** We are still more or less in the experimental stage on wire. We know that we can coat wire with various coating weights within reason, we know that we can do a good job, but our order books are in such shape that we haven't any tonnage left for this product.

**Member:** I would like to ask if you know of any research work that can be done to minimize the effects of the pinholes.

**Mr. Kellogg:** It depends on what you mean by research. We think we have largely learned how to avoid producing pinholes. As an example, on a sheet 36 inches wide, we'll say, and 120 inches long, cutting 9 6-inch square samples out of the sheet, when our practice has been as good as we want it to be and where we feel that we can control it, we quite often have found no pinholes on the top or bottom surface of any of these 9 samples. If we don't find any pinholes in these samples, the assumption is that there are no pinholes on the entire sheet.

**Member:** Have you tried redrawing the coated wire?

**Mr. Kellogg:** Yes, and it works very nicely. We haven't used any lubricants between the coating and the die, although I have thought that perhaps the lubricants that are used in redrawing galvanized wire would work very nicely. The drawing after coating at least smears the pinholes closed so that they don't show up very soon, if ever.

**The Chairman:** Mr. Kellogg, there are questions that haven't been asked, but I think it would be quite interesting if you would indicate the weight of the coating that you are getting on sheet and wire, give some idea about what that runs.

**Mr. Kellogg:** We haven't decided in our own minds what the proper weight of coating would be to put on sheets for a good commercial job, that is, to afford enough protection to make them really worthwhile. We feel, also, that as we progress in eliminating pinholes, we can probably also go to lighter coatings to get the same results. We can lead alloy coat sheets in substantially the same weights as sheets can be galvanized. That is, counting the two surfaces of the sheet, we can put on anywhere from maybe .70 of an ounce per square foot to 2 ounces per square foot. In the case of wire, we can put from .20 of an ounce per square foot to perhaps .75 of an ounce per square foot. It is possible that we could put heavier coatings on than that, but at the present time we don't feel they are necessary.

**Member:** What is the relative cost?

**Mr. Kellogg:** The metal itself costs more than the zinc. We have done more coating of sheet than we have of wire. We are getting slightly more for lead-coated sheets than we are for galvanized sheets. The lead coated articles can be more easily fabricated. The cost of fabricating, including the lower cost of breakage and factors like that reduce the cost of the finished article.

**Member:** You spoke of this molten flux. How deep do you have to have that?

**Mr. Kellogg:** It doesn't have to be deep in coating wire. The wire is substantially horizontal through the whole operation, so that the wire will go through at an angle of perhaps five degrees. The depth need not be more than two or three inches.

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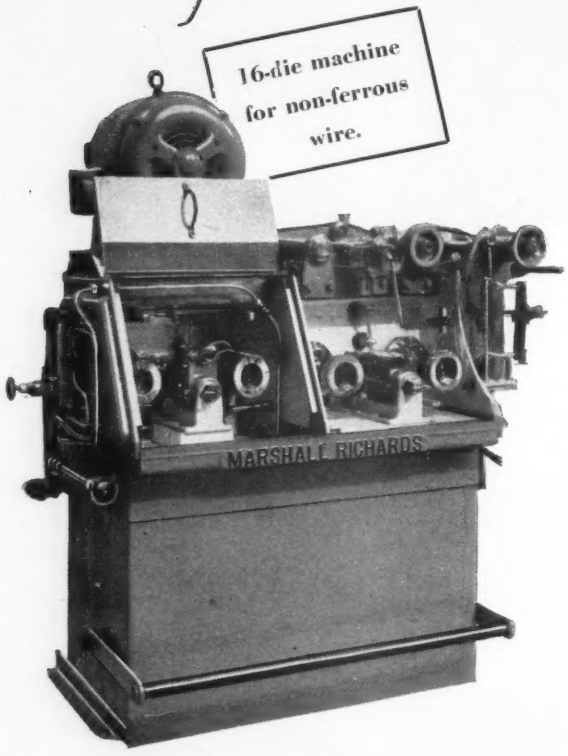


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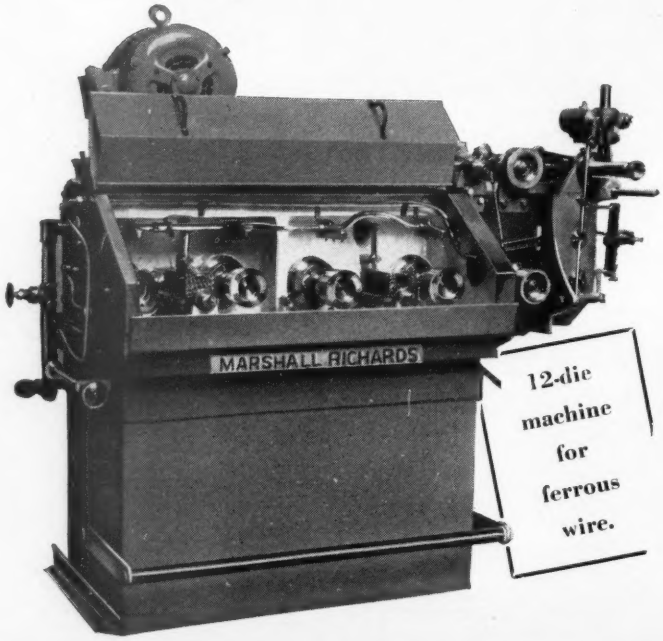

**Member:** May I ask what about the temperatures you run on your wire?

**Mr. Kellogg:** Those are variable, depending on how you are finishing the wire.

**Member:** Mr. Kellogg, is there any comparison of the corrosion of zinc and lead?

**Mr. Kellogg:** I am under the impression, and I don't think I am mistaken, that lead alloys corrode about forty per cent more slowly than zinc. Reasoning from that, it would seem that .6 of an ounce of lead alloy would do the same job as an ounce of zinc.

**Member:** Mr. Kellogg, this morning in a paper the point was brought out about torsions, high-strength galvanized wire, for instance improved plow steel. Have you done any work along that line in lead coating zinc?

**Mr. Kellogg:** We are not in the rope wire business. Maybe someone who is might answer that.

**The Chairman:** You are no doubt thinking of the temperature involved, is that it?

**Member:** Well, in the formation of the zinc iron alloy, Mr. Simmons brought out the fact that he wouldn't guarantee 25 torsions. I was just wondering whether it failed, whether the zinc iron alloy was the cause of a too-brittle range, and whether the lead coating would eliminate any tendencies of that sort as far as the lowering of torsions. I wonder if any work has been done along that line?

**Mr. Kellogg:** We are sure that there is no brittleness in lead alloy coating. That is brought out in the workability of the lead alloy coated. Such a sheet will do deep-drawing jobs that a similar uncoated sheet will not do. That might answer your question at least in part.

**Member:** Mr. Kellogg, I would like to ask if the lead alloy coated sheet will spot weld properly. Is the weld accompanied by the usual squirt that you get with zinc coated sheets?

**Mr. Kellogg:** It is not perhaps the same squirt, but you can successfully spot weld lead alloy coated sheet.

**Member:** Mr. Kellogg, have you done any work with lead alloys that contain no tins whatever?

**Mr. Kellogg:** No.

**The Chairman:** Are there any further questions? If not, we will pass on to the next paper.

## PAPER: "HYDROGEN BRITTLENESS IN SPRING STEELS"

Mr. Rodman R. Tatnall presented his paper.

**The Chairman:** I am sure Mr. Tatnall will be very glad to answer any questions now.

**Member:** I haven't a question at the moment, but I would like to mention a little experiment that I conducted many years ago that might have a little bearing on this question of hydrogen. I will outline the experiment and the result and let you draw your own conclusions as to just what caused it.

We took a half a dozen oil tempered springs and placed them over two posts, put them under tension, on one board. Then we took another board and we put a half a dozen more springs under the same condition, under the same tension, and on the third board we put six more. These springs were close-wound springs made of oil tempered wire.

We then on the first board dipped the board quickly into a cleaning solution. The second board we sprinkled with the same solution. The third board we didn't subject to any cleaning whatsoever. We took the third board with the six springs and baked each spring for a couple of hours under a temperature, as I remember it, somewhere around 250 to 300, and overnight, and the next morning we examined the three boards.

The board that had been dipped into the acid, or the cleaning solution, had every spring broken. The second board, the one that we just sprinkled with a light sprinkle, had about half the springs broken. The board that had simply been baked overnight and had no cleaning solution, the springs were all intact and between the posts.

**Mr. Tatnall:** You didn't mention whether these springs were rinsed after you took them out. The ones that were dipped, were they rinsed?

**Member:** They were rinsed. I don't want to stick my neck out as to what might have happened there. Personally, I think that the hydrogen embrittlement formed two different degrees. In the lightly sprinkled one, there was a high degree embrittlement.

**Mr. Tatnall:** The baking is the thing that helps, although baking under tension is something else again. It occurred to me that possibly the examples that were sprinkled only got enough acid to react in a comparatively small degree, and then the acid was used up so it couldn't generate enough hydrogen to have the same effect.

**Member:** That was shown in the results, because half of those broke, and in the other one all the springs were intact.

**Mr. Tatnall:** It is very hard to put your finger on the actual mechanism of how this brittleness gets there. We haven't had time to get into it. It is going to take a lot of time to develop that properly.

**Member:** Is anything being done to prevent the breaking of the wire in the pickling tank?

**Mr. Tatnall:** You're speaking of the heat treated wire? I doubt it, because the oil tempered wire is so susceptible. You can't clean it fast enough to do any good. Of course, there is another factor there. Oil tempered wire in the coil is under a stress. It might be low, but it is under a stress. Some sizes of the wire are probably a little over the elastic limit. Other sizes would be under the elastic limit. The minute you put that sort of wire, under stress, in the acid, I don't think you can pull it out fast enough to keep it from breaking. It will snap right off. It is a fascinating subject for research.

**Member:** With regard to what a previous speaker said, I would like to know what the atmosphere was during the testing and baking period. Was it hydrogen atmosphere, or oxygen, or some other? It would be very interesting to compare.

**The Chairman:** Are you asking a question?

**Member:** I would like to know how he conducted that. Another speaker mentioned the atmosphere maintained.

**Member:** It was just ordinary air, just the ordinary atmosphere during the baking.

**Member:** Would it be possible to conduct the same test with a nitrogen atmosphere?

**Member:** Yes, you can do it any way you choose.

**Member:** I would like to find out, did you conduct tests to determine the carbon content?

**Mr. Tatnall:** I didn't go into that part of it at all, except to choose the general type of steel.

**Member:** I would like to ask Mr. Tatnall—it was probably in your talk, but I didn't quite grasp it—did you make any comparison between sulphuric hydrochloric nitrogen for pickling operations?

**Mr. Tatnall:** I made no direct comparison. It is a good subject for research.

**Member:** I might add, it has been our experience with electro-plating that it is often desirable if a forming operation could be done after plating, rather than before. In a number of cases that has solved the brittleness that has developed during the plating that Mr. Tatnall referred to earlier in his talk.

The gentleman back here mentioned his own personal experience. Here is a little incident, my first introduction to embrittlement, and also my first introduction to plating. I was given the job of plating some toy pistols for samples. The things began to pop off, and I found after some experimental work that was carried on, but there is still plenty of room for additional research, that if we had our choice we would take the hot sulphuric acid rather than the hydrochloric.

**The Chairman:** This discussion recalls a test that was made some years ago, where very thin plates of various steels in various conditions of temper, from annealed to drawn steels, were placed between a receptacle which had hydrogen placed under pressure. And above the plate, a partial vacuum was created, and the amount of hydrogen that was passed through this plate, and also the amount that was included in the plate was later determined. The various types of steels, with their different annealing and different conditions of temper, show the wide variation in their ability to hold hydrogen. Some were just like a sponge. They took it up and held it. Some took it up and couldn't hold it. And the amount that passed from the receptacle under pressure at the bottom of the apparatus and the partial vacuum through the plate into this partial vacuum, varied with these different thin plates of steel.

Are there any other comments or questions?

**Member:** Mr. Chairman, based on certain tests it has been found that certain steels in different tempers are more subject to acid breaks than other tests that are tempered at different temperatures. For instance, an oil tempered draw, if not tempered at all, temper not drawn at all, would not be subject to breakage as much as if the temper is drawn at a regular low temperature. I forget what the temperature is, 4 or

500 degrees. As you reach the temperature, the drawing temperature, it becomes less subject to acid breakage.

**The Chairman:** Are there any further comments? If not, Mr. Kellogg and Mr. Tatnall, I am sure that I express the appreciation of everyone here for these very excellent presentations that you have made. (Applause)

## Session, Thursday, October 21, 1943 - 9:45 A. M.

### Chairman of Meeting

**Glenn E. Rolston, Chief Engineer,**
**Rome Cable Corporation, Rome, New York**

| | | |
|---|---|---|
| **PAPER: "Fiberglas as an Electrical Insulation"** | **L. T. Russell, Electrical Engineer,** | **Owens-Corning Fiberglas Corp., Newark, Ohio** |
| **PAPER: "The Use of Cellulose Acetate Butyrate as Primary Insulation for Wire and Cable"** | **H. E. Allen, Manager, Industrial Sales,** | **The Dobeckmun Company, Cleveland, Ohio** |

### PAPER: "FIBERGLAS AS AN ELECTRICAL INSULATION"

**Chairman:** I feel that I am not qualified by past experience to act as Chairman of your meeting inasmuch as this is the first meeting of the Wire Association that I have ever attended. It is my understanding that your programs are usually centered around problems in connection with rolling, drawing, annealing or stranding of non-ferrous metals, and that this is the first program that you have arranged which is to be devoted to insulations.

I think your program committee has used good judgment in selecting some of the newer types of insulations and coverings for today's program because during the next few years the wire industry is going to use these new materials in many types of work and familiarity with their properties and characteristics is going to be necessary in order to make certain that the proper materials are selected for each use. The wire industry has relied on six basic types of insulating materials for the past 75 years, and both the manufacturer and the consumer have become very familiar with their properties. These materials are: (a) paper (b) varnished cambric (c) cotton (d) asbestos (e) rubber, and (f) enamel. Each of these materials have certain limitations which are well recognized and as a result the operating practices for each class of insulation have been established under national standards.

In the past four or five years we have had new insulating and covering materials introduced in the wire industry and some of them have had a wide acceptance. Within the past year additional new synthetic materials have been introduced as a war measure because of the fact that rubber is no longer obtainable.

A list of some of these new materials includes the following: Neoprene, Thiokol, Buna S, Buna N, Butyl, Koroseal, Vinylite, Ethyl, Cellulose, Cellulose Acetate, Butyrate, Glass, Vinyl Acetal, etc.

In planning today's program your committee has chosen three basic types of insulation that are now being used on a very large scale and the experience to date has indicated that they have many desirable properties not found in the other classes of insulating materials which we formerly had available.

The two papers which are being presented this morning cover two classes of insulating and covering materials that are very often used together in special wires used on radio and radar equipment. We are particularly fortunate in having Mr. Russell, of the Owens-Corning Fiberglas Corporation, present a paper on "Fiberglas," inasmuch as this Company has not only conducted a great deal of development in their own laboratory but have also cooperated on development work in the plants and laboratories of the various wire manufacturers.

I take great pleasure in introducing Mr. Russell of the Owens-Corning Fiberglas Corporation.

Mr. L. T. Russell presented the above mentioned paper.

**The Chairman:** If any of you gentlemen would like to open the discussion or ask any questions of Mr. Russell, I am sure he would be glad to answer them.

**Member:** I would like to ask you a question about the statement you made at the beginning of your talk. You said that you use some kind of a lubricant on the glass fiber. What type of lubricant do you use?

**Mr. Russell:** It is an oil and starch base material very similar to a standard textile fabric binder or size. I am not familiar with rayon especially, but most of the standard textiles have a starch-like size on them. For instance, when you buy a shirt or a piece of fabric, it usually has a binder or size or lubricant on it to make the fibers lay down smoothly and give it better appearance. Our Fiberglas textile size or lubricant as we generally call it, is very similar to that; it is a starch and oil base compound.

**Member:** To what extent is Fiberglas staple yarn being used for magnet wire insulation?

**Mr. Russell:** It is being used quite extensively by one company in particular and is being tried by others. It is not used as much as the continuous filament yarn for magnet wire covering, but one large user has found it satisfactory.

**Member:** Has fiberglas been used very extensively for other wire and cable applications besides primary wire for power application?

**Mr. Russell:** Yes, it is being used a great deal for magnet wire, as I mentioned and for many types of radio wires, instrument wire, and ignition cables. It is used for many other standard and special types of cables where higher heat resistance, flameproofness and other properties of glass are needed.

**Chairman:** Thank you very much, Mr. Russell, that was a very excellent paper.

### PAPER: "THE USE OF CELLULOSE ACETATE BUTYRATE AS PRIMARY INSULATION FOR WIRE AND CABLE"

**The Chairman:** I would like to add one little feature to our program, which is of a rather selfish nature. There are a good many wire manufacturers represented here, and material suppliers to the wire manufacturers, that are very much interested in the present situation with regard to standardization of specifications on radio and radar equipment.

It so happens that **Mr. Ray Zender,** of the WPB War Committee on Radio is here. I haven't arranged this with him, but I would like to ask Ray if he would give us a few minutes and tell us about the present status of the proposed ASA standards of the War Committee on Radio. Mr. Zender. (Applause)

**Mr. Ray Zender:** Gentlemen, there are many of you here who have attended the standardization meetings on hookup wire on the specification C-75, which was mentioned by Mr. Allen. The status of that specification at present is that we completed the last review of it on the 21st of October, and the ASA is editing it, to be sent out for balloting. We hope, of course, that we receive a favorable response from all of those who are interested.

As related to previous specifications that have been written on hook-up wire by the Navy and the Army, specifically the 71-1677 mentioned, which is a Signal Corps specification, this new specification is intended to supersede these specifications upon issuance. It is a specification that we hope will cover approximately ninety per cent of the hook-up wire that is required in hooking up radio trans-

mitters, receivers and electronic devices, including test instruments, required by the Armed Services.

The services feel, however, that there is need of another type of specification that will be somewhat upgraded above this C-75, and a task committee has been appointed to survey this. The committee consists principally of equipment manufacturers and members of the armed forces, and it will determine the type of specification that is required. The results of their observation would be a monitor specification that would later be gone over by the industry in general.

I might add that this C-75 specification is a performance specification. However, there is a reference for the sake of guidance of manufacturers of extruded plastics, thermoplastic tapes, covered with glass, cotton or rayon. The specification is so designed that it will permit the acceptance of these various materials just mentioned.

Just a brief history of the standardization program: This program was inaugurated by **Mr. Sidney Wolfe,** Assistant Director for Production, War Production Board, Radio Division. More than $250,000 have been appropriated to carry on the task and the American Standards Association was selected to act as an intermediary agent in the editing and preparing and the conducting of meetings for the standardization of various radio component parts. Standardization implies a limitation of the number of varieties or types composing the given class or else a degree of likeness among individuals of each type. It is hoped that the adoption of the new wire specification will probably reduce the number of types of hook-up wire from about twenty to probably a combination of seven or eight types.

I think that is about all I have to say from the standpoint of information on the government specifications. Thank you very much for this opportunity. (Applause)

**The Chairman:** I want to thank Mr. Croch and Mr. Zender for their participation in the program. I think that as a part of your program for next year you may want, after hearing the additional papers today, to consider the possibility of keeping up on insulations as well as with other problems. Next year you will hear about not only dozens, but maybe hundreds of new synthetic materials.

If there is no further business to come before us, the meeting is adjourned.

## Session, Thursday, October 21, 1943 - 1:45 P. M.

### Chairman of Meeting

**Benjamin H. Davis, Engineer,**
**John Royle & Sons, Paterson, N. J.**

| | | |
|---|---|---|
| **PAPER: "Properties and Uses of Vinyl Resins for Wire and Cable"** | **G. A. Fowles, Engineer, Plastics Material Div.,** | **B. F. Goodrich Company, Akron, Ohio** |
| **PAPER: "Extrusion of Vinyl Compounds in the Wire and Cable Industry"** | **H. K. Intemann, Sales Manager,** | **Halowax Products Division, Union Carbide & Carbon Corporation, New York, N. Y.** |

### PAPER: "PROPERTIES AND USES OF VINYL RESINS FOR WIRE AND CABLE"

**The Chairman:** Mr. Fowles would be very pleased to answer any questions that any of you gentlemen have on this subject. Are there any questions?

**Member:** I would like to ask a question. I myself made extensive tests on vinyl chloride compounds and the resin compounds. I am very pleased with the results, but they are very expensive. It is a question of economy. Do you think they can actually be compared with any other material, even with regard to the price? That is one question.

The other question is, you stated that you made tests sixty days under water. How much water pressure do you put on it? In other words, I want to ask you if you maintained this wire under steam conditions?

The third question, if you maintained it in outdoor conditions under humidity conditions.

One other question is, how do you compare your compounds with the new polystyrene compounds put out by the Standard Telephone & Cables, Ltd, London, on the basis of the new English 548-708.

**Mr. Fowles:** Thank you. Before I answer those questions, let me give you a little definition I heard the other day that may be quite apt.

An engineer is said to be a man who knows a great deal about very little, and who goes about knowing more and more about less and less until he ends up in life knowing everything about nothing. (Laughter)

A salesman, on the other hand, is a man who knows a very little about a great deal. As he goes through life he learns less and less about more and more, until he knows nothing about everything. (Laughter)

I have one more. A purchasing agent starts out knowing practically everything about everything, but due to his unfortunate association with engineers and salesmen, he ends up knowing nothing about nothing. (Laughter)

To answer those questions, first of all, it is very difficult to predict what the price of the materials will be. We think that as increasing production facilities are made available and as we learn more about producing these materials, undoubtedly these gains will be passed along to the consumer in the form of reduced costs. We know very little about what the government is going to do after the war. Right now some of the synthetic rubbers are subsidized. We don't like to compete with subsidized manufacturers, and no one likes to do that. I can't give you any kind of a definite answer as to what the price will be after the war.

Your other question,—with regard to water immersion, these tests of which I spoke at first; the seventy degree tests were made in ordinary water, obviously not steam.

I am a little at a loss to remember all the other details. I think perhaps we'd better get together after the meeting to get all those facts down, because you gave me a lot of them.

Are there any other questions, gentlemen?

**Member:** Was there a swelling effect? How much water was taken up?

**Mr. Fowles:** That brings up another interesting phenomenon of the vinyl resins. Sometimes they swell and sometimes they don't. We have made tests in the laboratory to determine what some of these things do, and we find that the water goes in and out, sometimes changes places with the plasticizers. It depends entirely upon the period of time, the temperature and the pressure used in the test to determine what the result is going to be.

**Member:** I asked you what the pressure was.

**Mr. Fowles:** That particular test I quoted was a laboratory tank, probably only a foot and a half deep.

**The Chairman:** Are there any other questions? Thank you, Mr. Fowles. (Applause)

### PAPER: "EXTRUSION OF VINYL COMPOUNDS IN THE WIRE AND CABLE INDUSTRY"

Mr. H. K. Intemann then presented his paper.

**The Chairman:** Have we any questions on this?

**Member:** I would like to ask, I don't quite get the setup on the breaker screen, the breaker place of the heavier place has larger holes, is that right?

**Mr. Intemann:** That's right. If this were the cylinder of your extrusion screen, we put a plate in there (indicating), this is the breaker plate that I talked about, with the holes in it, and the screens are inserted right in there, and that acts as a backing for the screen.

**Member:** I see. Is that a regular sixty mesh?

**Mr. Intemann:** That is correct.

**The Chairman:** Are there any more questions? Thank you, Mr. Intemann.

We will now have a short motion picture entitled "Rubber in Industry."

The convention then adjourned.

# Efficiency Requirements In Purchasing

By Thomas W. Fazakerley,
West Wickham, Kent, England.

IN NO matter what factory, it is the primary objective of the purchasing personnel to obtain the materials required at the best prices from the correct markets at the right times. There is an ever-present temptation to buy in a much larger quantity than is needed or normal, in order to reap the benefit from a 'turn' on the price. On face value, such a step might appear to be advisable in these days of reducing supplies and rising costs, but nevertheless a move of this nature may prove to be of uneconomic value if the difference between the higher and the lower prices exceeds the cost of investing the capital so employed i.e. the interest on the capital sum if invested for the period in question at normal rates.

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FACTORIES of average size will usually retain one purchasing section to attend to the buying for the whole organization. Such methods are probably the only ones available to those affairs of modest resources but there is the added danger that the individual buying agents may not be intimately acquainted with the various commodities coming within their purchasing province. When this is so, it is open to question whether such a department or such an arrangement is able to arrange the best terms or obtain the finest qualities.

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THE system employed by the larger companies is the only one which can be compared with that just outlined. Their system consists of employing a specialist for each class of material handled. Naturally, such methods involve considerably greater overheads but against this additional expenditure there is the advantage which will accrue from scientific buying knowledge, an advantage which cannot but work out favorably in the calculation of the net purchasing costs.

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## A Definite Purchasing Scheme

THE question of purchasing policy is obviously one which will be laid down by the management who will inform their employed buyers of their maxima and minima in the matter of requirements. Within such limitations the buyer is permitted and expected to exercise his own judgment and discretion and to formulate his own individual policy following market and general conditions. His prime consideration when buying will be to make his bids on a rising market although he must not be guided by that consideration alone.

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## Purchasing and Stores Departments

WHEN the whole of a factory requirements are purchased by one department of non-specialists it is of vital necessity that exact classification of all stocks is arranged and that a statistical system is devised which is capable of immediate and intelligent appreciation. The vagaries of individual industrial requirements are so great that concrete suggestions for reliable systems cannot be included in this brief article. A multitudinous stock will be the forerunner of difficulties in allocation and distribution unless the recording system is watertight. Standardization of stocks and commodities (a very difficult and in most cases impossible objective) must lead towards reduced management expenditure, improved delivery possibilities and a reduction in the number of entries in the bought ledger, a step which, in itself, tends towards simplification of record and book keeping.

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## Essentials of Purchasing

IT IS usual for organizations to maintain entirely segregated stock and purchasing departments so that when the former sees that certain commodities are reaching that minimum which is compatible with safety, they will so inform the purchasers. The next step is for the buying agent to contact his market and, having allocated his requirements he must necessarily confirm them. It is with this confirmation that the greatest possible care must be taken if subsequent difficulties are to be nullified at the outset. Many items incidental to efficiency must be referred to in this confirmation but the most important are the following:-

1. **that recognition of the official order only will be given.**
2. **that delivery is required on the date specified.**
3. **that any correspondence must quote the contract number, index letter and reference.**
4. **that the terms of payment tentatively arranged hold good.**
5. **that concise instructions regarding containers, crates and delivery arrangements are given.**

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IT is probable that the activities of most buyers will terminate with the actual procedure of buying but nevertheless the buying department must maintain adequate records which will be of great importance for purposes of

(*Please turn to Page 67*)

# Outstanding Personalities of the Wire Industry

### H. G. Coffey, V. P. Chg. Sales, Aetna Standard Engineering Company

ANNOUNCEMENT of the election of **H. G. Coffey,** former manager of sales, as vice president in charge of sales and production was recently made by the Aetna Standard Engineering Company of Youngstown, Ohio.

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### Wickwire Spencer Elects Director

THE Wickwire Spencer Steel Company has announced the election of **Mr. Samuel D. Lunt** as a member of the Board of Directors replacing **Mr. Charles G. Terry.** Mr. Lunt is the managing partner of the firm of Hamlin & Lunt, of Buffalo, New York.

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### Paul Barnhart, Sec'y-Treas., Riverside Metal Company

PAUL BARNHART was recently appointed secretary-treasurer of Riverside Metal Company, Riverside, New Jersey, and **J. C. Blake,** formerly priority manager, has been appointed general sales manager.

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### American Steel & Wire Shifts Ostlund to Cleveland

E. C. OSTLUND has been appointed assistant chief industrial engineer of the American Steel & Wire Co., U. S. Steel subsidiary, with offices in Cleveland, Ohio. At the same time, **Evarts C. Hall** has been named works industrial engineer at South Works, Worcester, Mass., to succeed Mr. Ostlund.

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MR. OSTLUND has been associated with the American Steel & Wire Co. since October, 1936, when he was made an industrial engineer in the Worcester district manager's office.

### A. E. Reinhard Resigns

A. E. REINHARD has resigned as superintendent of Youngstown Sheet & Tube Company, Campbell Works, Youngstown, Ohio, to become superintendent of steel production with the Great Lakes Steel Corporation, Ecorse, Mich.

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### Benjamin J. Lazan Awarded Noble Prize

BENJAMIN J. LAZAN, chief engineer and vice president of the Sonntag Scientific Corporation of Greenwich, Conn., an affiliate of the Baldwin Locomotive Works, Philadelphia, Pa., has been awarded the Alfred Noble Prize for 1943 for the most outstanding research work in any field of engineering.

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### John F. Hazen Retires

SUCCEEDING **John F. Hazen,** who has retired because of ill health, **Ralph E. Sharp** has been appointed manager of sales, Wire and Wire Products Division, Bethlehem Steel Company, Bethlehem, Pa.

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### Norton Appoints R. M. Johnson General Sales Manager

RALPH M. JOHNSON has been appointed General Sales Manager of grinding wheels and abrasive grain for the entire United States by Norton Company. He will make his headquarters at the Worcester plant. Mr. Johnson has been Norton Western Sales Manager since 1939.

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MR. JOHNSON was graduated from Worcester Polytechnic Institute in 1915 with a bachelor of science degree in chemistry. Shortly after graduation he joined the Norton Company research staff, working first in the organic laboratory and then in the mechanical laboratory and has been with the Company in various capacities ever since.

### Joins Roebling

W. C. PALMER, associated with the John A. Roebling's Sons Company since 1926, has been appointed Manager of Sales of Round, Flat Wire and Specialties Division at Trenton, New Jersey.

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MR. PALMER is an engineering graduate of Union College, and represented the company for several years as a salesman in New York City and Buffalo. For the past year he was the Assistant Branch Manager of the company at Cleveland.

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### Wickwire Spencer Steel Names Dunlap Assistant to the President

MR. E. P. HOLDER, President of Wickwire Spencer Steel Company has announced the appointment of **Mr. Robert T. Dunlap** as Assistant to the President.

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MR. DUNLAP is well known in the steel industry as an authority on plant installations, production and operation. Prior to joining Wickwire Spencer he was General Works Manager of the Vulcan Iron Works at Wilkes-Barre, Pa.

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MR. DUNLAP has also been associated with the Elliott Company of Jeanette, Pa., as Production Superintendent, with Jones & Laughlin Steel Corporation of Pittsburgh as Engineer, Production and General Superintendent, and with the Pittsburgh Bridge and Iron Works as Plant Manager.

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MR. DUNLAP will be located at the company's home office at 500 Fifth Avenue, New York, 18, N. Y.

(*Please turn to Page 69*)

# STATISTICS

## CAPACITY AND PRODUCTION FOR SALE OF IRON AND STEEL PRODUCTS

**As reported by American Iron and Steel Institute**

**(For July, 1943)**

| | Number of companies | Items | Annual Capacity Net tons | Production for Sale—Net Tons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Current Month | | | | Year to Date | | | |
| | | | | | | Shipments | | | | Shipments | |
| | | | | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products |
| Wire rods | 22 | 25 | | 98,506 | ... | | 19,422 | 696,377 | ... | | 138,255 |
| Wire—Drawn | 41 | 26 | 2,356,550 | 164,120 | 82.2 | | 5,970 | 1,139,387 | 83.2 | | 35,047 |
| Nails and staples | 19 | 27 | 1,116,640 | 65,923 | 69.6 | | ..... | 490,504 | 75.6 | | ..... |
| Barbed and twisted | 15 | 28 | 482,280 | 20,480 | 50.1 | | ..... | 142,567 | 50.9 | | ..... |
| Woven wire fence | 16 | 29 | 778,060 | 23,224 | 35.2 | | ..... | 129,626 | 28.7 | | ..... |
| Bale ties | 12 | 30 | 128,420 | 9,929 | 91.2 | | ..... | 65,414 | 87.7 | | ..... |
| All other wire products | 8 | 31 | 78,220 | 4,536 | 68.4 | | ..... | 35,624 | 78.4 | | ..... |
| Fence posts | 11 | 32 | 112,065 | 5,356 | 56.4 | | ..... | 19,289 | 29.6 | | ..... |

**(For August, 1943)**

| | Number of companies | Items | Annual Capacity Net tons | Production for Sale—Net Tons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Current Month | | | | Year to Date | | | |
| | | | | | | Shipments | | | | Shipments | |
| | | | | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products |
| Wire rods | 22 | 25 | ..... | 93,438 | ... | | 17,457 | 791,093 | ... | | 155,712 |
| Wire—Drawn | 41 | 26 | 2,356,550 | 163,852 | 81.8 | | 5,116 | 1,314,138 | 83.7 | | 40,163 |
| Nails and staples | 19 | 27 | 1,116,640 | 62,004 | 65.4 | | ..... | 552,508 | 74.3 | | ..... |
| Barbed and twisted | 15 | 28 | 482,280 | 19,438 | 47.4 | | ..... | 162,005 | 50.4 | | ..... |
| Woven wire fence | 16 | 29 | 778,060 | 24,675 | 37.3 | | ..... | 154,301 | 29.8 | | ..... |
| Bale ties | 12 | 30 | 128,420 | 9,921 | 90.9 | | ..... | 75,335 | 88.1 | | ..... |
| All other wire products | 8 | 31 | 78,220 | 4,460 | 67.1 | | ..... | 40,084 | 77.0 | | ..... |
| Fence posts | 11 | 32 | 112,065 | 5,474 | 57.5 | | ..... | 24,763 | 33.2 | | ..... |

**(For September, 1943)**

| | Number of companies | Items | Annual Capacity Net tons | Production for Sale—Net Tons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Current Month | | | | Year to Date | | | |
| | | | | | | Shipments | | | | Shipments | |
| | | | | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products |
| Wire rods | 22 | 25 | ..... | 107,530 | . | | 16,089 | 897,345 | . | | 171,801 |
| Wire—Drawn | 41 | 26 | 2,356,550 | 172,942 | 89.4 | | 2,325 | 1,487,080 | 84.4 | | 42,488 |
| Nails and staples | 19 | 27 | 1,116,640 | 64,013 | 69.8 | | ..... | 616,521 | 73.8 | | ..... |
| Barbed and twisted | 15 | 28 | 482,280 | 20,885 | 52.7 | | ..... | 182,890 | 50.7 | | ..... |
| Woven wire fence | 16 | 29 | 778,060 | 27,222 | 42.6 | | ..... | 181,523 | 31.2 | | ..... |
| Bale ties | 12 | 30 | 128,420 | 9,603 | 91.1 | | ..... | 84,938 | 88.4 | | ..... |
| All other wire products | 8 | 31 | 78,220 | 4,565 | 71.1 | | ..... | 44,649 | 76.3 | | ..... |
| Fence posts | 11 | 32 | 112,065 | 5,867 | 63.8 | | ..... | 30,630 | 36.5 | | ..... |

**(For October, 1943)**

| | Number of companies | Items | Annual Capacity Net tons | Production for Sale—Net Tons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Current Month | | | | Year to Date | | | |
| | | | | | | Shipments | | | | Shipments | |
| | | | | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products | Total | Per Cent of capacity | Export * | To members of the industry for conversion into further finished products |
| Wire rods | 22 | 25 | ..... | 104,308 | ... | | 16,937 | 1,001,653 | ... | | 188,738 |
| Wire—Drawn | 41 | 26 | 2,356,550 | 168,837 | 84.3 | | 2,118 | 1,655,917 | 84.4 | | 44,606 |
| Nails and staples | 19 | 27 | 1,116,640 | 62,740 | 66.1 | | ..... | 679,261 | 73.0 | | ..... |
| Barbed and twisted | 15 | 28 | 482,280 | 20,735 | 50.6 | | ..... | 203,625 | 50.7 | | ..... |
| Woven wire fence | 16 | 29 | 778,060 | 26,825 | 40.6 | | ..... | 208,348 | 32.1 | | ..... |
| Bale ties | 12 | 30 | 128,420 | 7,587 | 69.5 | | ..... | 92,525 | 86.5 | | ..... |
| All other wire products | 8 | 31 | 78,220 | 4,604 | 69.3 | | ..... | 49,253 | 75.6 | | ..... |
| Fence posts | 11 | 32 | 112,065 | 7,445 | 78.2 | | ..... | 38,075 | 40.8 | | ..... |

# ✦ GOVERNMENT WIRE PRODUCTION INFORMATION ✦

### W.P.B. Issues Order On Copper Wire

MANUFACTURERS of copper wire will be interested in CMP Regulation 9, Part 3175 as amended November 26, 1943. This tells how retailers may get copper wire for retail sale, what retailers can buy the wire under this regulation, how much they can buy, what kinds of wire are covered, etc. Copies of this may be secured from the WPB, Washington, D. C.

✦ ✦ ✦

### Small Steel Order Regulations Liberalized

SMALL order provisions for steel, contained in CMP Regulation No. 4, have been liberalized with respect to wire (other than wire rope and music wire), pipe, galvanized sheets, tin and terne plate, and fence posts.

AS a result of the amendment, a distributor (warehouse) may fill orders, without receiving allotments, calling for delivery to one customer during any one calendar quarter of not more than 10 tons of carbon steel and 1,000 pounds of stainless steel in the above indicated product groups. Previously, distributors could deliver only 2,000 pounds of carbon steel and 100 pounds of stainless steel to one customer during any one calendar quarter in the indicated controlled material forms, without receiving an allotment.

✦ ✦ ✦

### WPB Lists Restrictions on Production of Fasteners

ON November 9th, the WPB removed all restrictions on the use of steel in the production of hooks and eyes, snap fasteners, and brassiere hooks made in any part of the country other than Labor Market Areas 1 and 2.

✦ ✦ ✦

PREVIOUSLY, quarterly steel consumption for these items had been restricted to the average quarterly use in the year ending June 30, 1941. This relaxation of the restriction means that the limitation on steel use applies only to producers in the two labor shortage areas.

✦ ✦ ✦

AT the same time, WPB, by its amendment of Order L-68, lifted the ban on the production of slide fasteners of more than 27 inches in length for civilian use.

✦ ✦ ✦

THE amended order also permits resumption of manufacture of buckles for shoes and cloth-

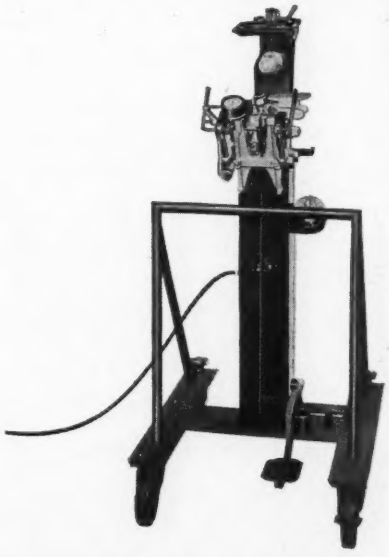
(*Please turn to Page 58*)

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.



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WIRE Plays Still Another Vital Wartime Role

Courtesy Superior Sleeprite Corporation

KEYSTONE Wire

After a hard day of training, our soldiers need energy-restoring sleep to regain vital strength for the bigger day ahead. That's why sturdy coil springs, made from wire furnished by Keystone and other wire mills, are used in making steel sleeping cots for our armed forces. Practically every piece of equipment used by our fighting men on land and sea includes wire in some form . . . from nails in their shoes to the guns and tanks with which they fight.

**Plan NOW for Postwar**

Wartime production has revealed untold new uses for wire; thousands of new fabricating techniques have been developed. So consult Keystone engineers immediately regarding the use of wire in your POSTWAR PRODUCTS.

KEYSTONE STEEL & WIRE CO.
PEORIA, ILLINOIS

Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE

Idle SCRAP IRON can delay Victory. Send every available pound to the steel mills NOW!


## Government Wire Production Information

(*Continued from Page 57*)

ing. These had previously been prohibited. Other changes are the use of steel in production of such items as buckles, burrs, clothing trim or ornaments, corset clasps, eyelets, hose supporters, etc. in Labor Areas 1 and 2 is limited for the first time to the rate prevailing in the 12 months ended June 30, 1941, and the manufacture of closed type steel buttons for use on coated fabric garments is permitted.

✦ ✦ ✦

## Brass Mills Production of Alloyed and Unalloyed Products in Third Quarter

THE Statistics Branch of the W.P.B. Copper Division has issued the brass mill production figures covering the third quarter of this year. The figures are given in a form wholly different from that employed when W.P.B. issued figures a month ago covering the 12 months ending June 1943 and it is therefore not possible at the moment to make any intelligent comparisons. Following are the figures issued by W.P.B. in thousands of pounds, metal weight:

**Alloyed Products**

| 1943 | Strip | Rod and Wire | Tubes | Totals four items |
|---|---|---|---|---|
| July | 304,734 | 70,746 | 21,347 | 396,827 |
| Aug. | 333,049 | 71,456 | 21,851 | 426,356 |
| Sept. | 355,214 | 72,458 | 22,732 | 450,404 |
| Tot. | 992,997 | 214,660 | 65,930 | 1,273,587 |

**Unalloyed Products**

| | Strip | Rod and Wire | Tubes | Totals four items |
|---|---|---|---|---|
| July | 10,592 | 8,821 | 9,407 | 28,820 |
| Aug. | 9,947 | 9,346 | 11,159 | 30,452 |
| Sept. | 9,950 | 8,655 | 10,813 | 29,418 |
| Tot. | 30,489 | 26,822 | 31,379 | 88,690 |

**Grand Totals — All Products**

| | |
|---|---|
| July | 425,647 |
| Aug. | 456,808 |
| Sept. | 479,822 |
| Total | 1,362,277 |

✦ ✦ ✦

## Copper for Screening Eased

THE War Production Board recently issued Amendment 1 to Conservation Order M-9-c, releas-

ing for unrestricted use copper insect screening which Copper Recovery Corporation has refused to accept, copper insect screening in any roll which has been cut before April 9, 1942, and used or second-hand insect screening.

✦ ✦ ✦

### Standard Industrial Issues New Catalog

STANDARD Industrial Compounds Company, 4600 West Ferdinand St., Chicago, 44, Ill., recently published a new catalog on wire drawing compounds. This handsome brochure presents in a foreword a historical sketch of the development of wire drawing from its early stages as an art down to its present state as a modern science. Following this, their various standard compounds are taken up separately, with the uses, characteristics and other details listed for ready reference by wire drawers, to facilitate the selection of the proper compound for different kinds of wire and conditions of operation. A feature of the book is a section devoted to the description of Stancoat, an entirely new product, developed to replace lime coatings on high or low carbon, where the use of lime is objectionable, providing a soft adhesive coating that is said to increase die life by reducing friction and causing the metal to flow better and deform more evenly. It is claimed to be acid in reaction and to remove scale, rust or carbon smut which may be present after pickling operations. However, it is not a true acid compound, but its reactions are characteristic of acid with the evolution of hydrogen. It is suited to either wet or dry drawing, and prevents rust in storage for long periods of time.

✦ ✦ ✦

COPIES of this new catalog will be sent to wire mill executives upon request.

### New Literature

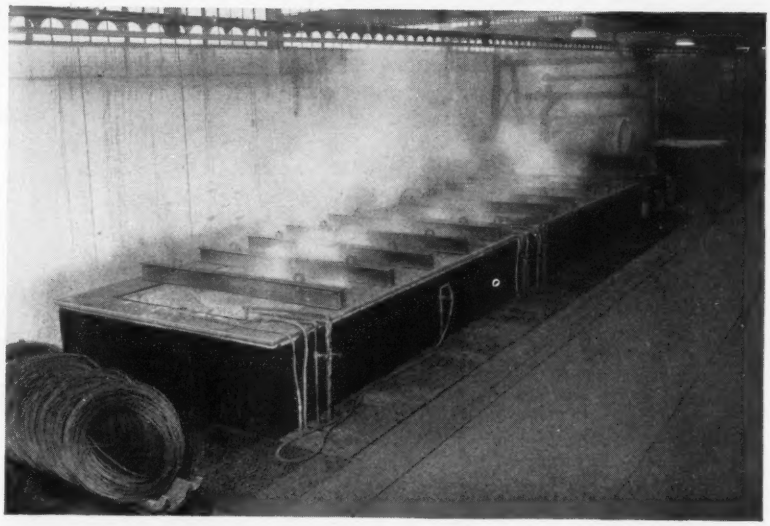
A NEW catalog of technical books has just been issued by The Chemical Publishing Co., Inc., 26 Court Street, Brooklyn 2, N. Y. This catalog includes the latest books on chemistry, technology, physics, general science, mathematics, engineering, radio, aviation, foods, formularies, cosmetics, gardening, medicine, metals technical dictionaries, etc.

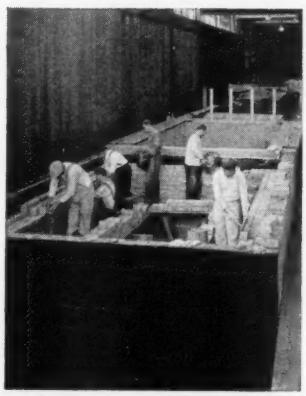
THIS catalog, conforming with the requests of technical and scientific workers and librarians, gives the date of publication of each book as well as a concise description and full table of contents.

✦ ✦ ✦

A COPY of this catalog will be sent free to everyone who is interested in keeping up with the latest technical and scientific progress.


# BASOLIT PICKLING TANKS





The above picture shows a three section BASOLIT wire pickling tank 70' long x 10' wide x 7' deep, installed August 1935 at the Sheffield Steel Corp., Kansas City, Mo.

Constructed with an inner lining of acidproof brick jointed with BASOLIT, and outer lining of reinforced concrete—also available in combination with rubber lined steel outer shell.

The installation illustrated is one of many hundreds where BASOLIT has contributed toward long life and efficient operation of modern pickling equipment.

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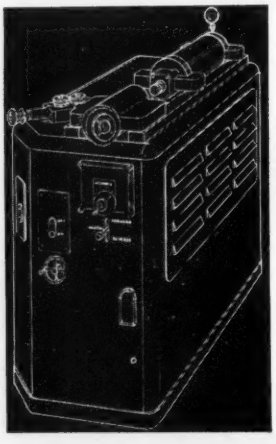

Here is a 12-ton laboratory type hydraulic unit suitable for duplicating conditions of actual production (10,000 lbs. per square inch pressure) . . . Comes complete, with extrusion die-head . . . Ready to set on your floor, connect to your power line and start producing . . . Hydraulic and electrical controls at operator's fingertips . . . Welded steel construction . . . A smooth-working, efficient unit . . . Can be delivered in twelve weeks under proper priorities . . . Full information on request.

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John A. Manning Paper Co.,
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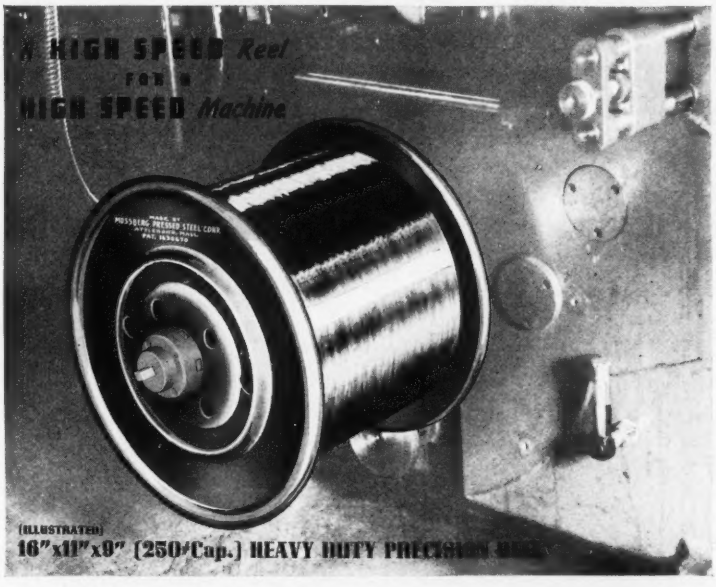
*(Please Turn to page 62)*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*(Continued from page 61)*

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Vancouver, B. C., Canada

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Western Electric Company,
Cicero, Illinois

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Camden Wire Company, Inc.,
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Firthaloy Div.,
Los Angeles, Calif.

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Heil Engineering Co.,
Cleveland, Ohio

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Braddock, Penna.

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Chicago, Illinois

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HUBBARD, L. A., Secy.-Treas.,
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*You are invited to avail yourselves of this stranding capacity.*

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Grasselli Chemical Dept.,
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*(Please turn to page 64)*


# MORE PRODUCTION IN LESS TIME with CARL-MAYER FURNACES, OVENS

**SERVING CONCERNS LIKE THESE:**

American Magnesium Corp.
Aluminum Co. of America
Atlantic Wire Co.
Atlas Steel Co.
Bridgeport Brass Co.
Eclipse Aviation Division of Bendix Aviation Corp.
Ford Motor Co.
General Electric Co.
General Motors Corp.
General Steel Castings Co.
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Hyatt Roller Bearing Co.
Page Steel & Wire Co.
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Thompson Products Co.
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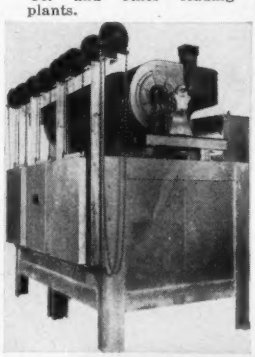
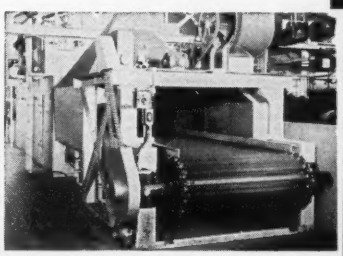
**CARL-MAYER BATCH TYPE FURNACE**

Carl-Mayer Recirculating Air Heater Type Batch Furnace, Gas Fired. Numerous batch type furnaces similar to this at Aluminum Co. of America, American Magnesium Corp., Thompson Products Co. and other leading plants.



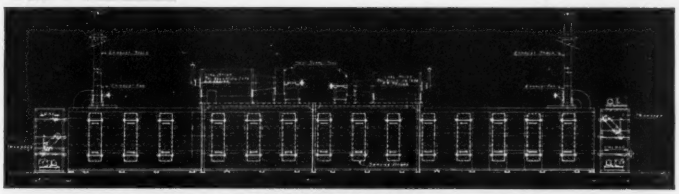


**CARL-MAYER FURNACE**

One of a number built for Bridgeport Brass for stress relieving Carl-Mayer Recirculating Air Heater Furnaces are widely used because of their fast heating cycle, uniformity and amazing fuel economy.

**CARL-MAYER HI-SPEED ROD BAKER**

The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. **Patented and patents pending.**



**WELDING ROD OVEN**

For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

**Carl-Mayer's creative ability is making furnace and oven history. Carl-Mayer equipment is not only built for super-speed and fuel economy but has the stamina to take the severe punishment of continuous production. Write for Bulletin 141.**

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## The Wire Association

*(Continued from page 63)*

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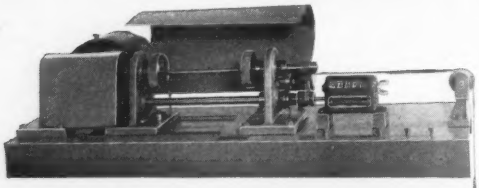
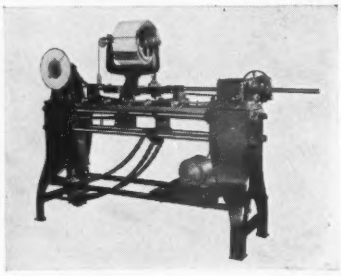
REHME, E. W., Chem. Engr.,
Automatic Electric Co.,
Chicago, Illinois
REICHL, REYMOND M., Sales Mgr.,
Hydropress, Inc.,
New York, N. Y.

# For Twist Testing of Wires, at New Accelerated Rate

***Scott Tester Model T-3 greatly speeds the testing process. The motor drive is so arranged that both ends of the specimen revolve, while other refinements assist in further accelerating the accomplishment of the desired result. Specimens may be any length from 2" to 8", and various degrees of tension of from ½ lb. to 17 lbs. may be applied. Numerous other wire testers are included in our 60 models, comprising machines for wires ranging from finest filament to 1 ton, performing tests for tensile, hysteresis, flexing, compression cutting of covering, etc., etc. Results are graphically presented on picturized charts for easy analysis and valuable as permanent record files.**



Model Q-7 Scott Tester. Heavy duty tensile tester for wire, with capacity of 2,000 lbs.

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Micro Products Company,
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W. H. Maze Company,
Peru, Illinois

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SCOTT, LEWIS F., Sales Engr.,
Haveg Corporation,
Chicago, Illinois

SCOTT, ROGER M., Chief Engr.,
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SICKELS, E. D., Adv. Mgr.,
WIRE & WIRE PRODUCTS,
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SIEMON, BRUCE W., Supt. Wire Dept.,
Pittsburgh Steel Company,
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Coal City, Illinois

SOMMER, W. B., Firthaloy Engr.,
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SOMMER, W. H., President,
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STOUT, R. M., Sales Engr.,
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Armour Research Foundation,
Chicago, Illinois

TATNALL, R. R., Met. Engr.,
Wickwire Spencer Steel Co.,
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THIBAUT, J. E., Supt. Gen. Die Dept.,
Anaconda Wire & Cable Co.,
Sycamore, Illinois

TIMMERMAN, E. D., Chemist & Supt., Wire Mill,
Steel Co. of Canada, Ltd.,
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Anaconda Wire & Cable Co.,
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TREMBICKI, HAROLD L., Mgr.,
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Magnus Chemical Co.,
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TUCKER, A. CLAIRE, Devel. Engr.,
Lee Wilson Engineering Co., Inc.,
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TWIBLE, W. J., Gen. Mgr.,
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Toronto, Ont., Canada

TYRRELL, W. B., Dist. Mgr.,
Keystone Steel & Wire Co.,
Chicago, Illinois

ULLRICH, HENRY F., Asst. Supt.,
John A. Roebling's Sons Co.,
Trenton, N. J.

UPDIKE, F. TITUS, Engr.,
John A. Roebling's Sons Co.,
Trenton, N. J.

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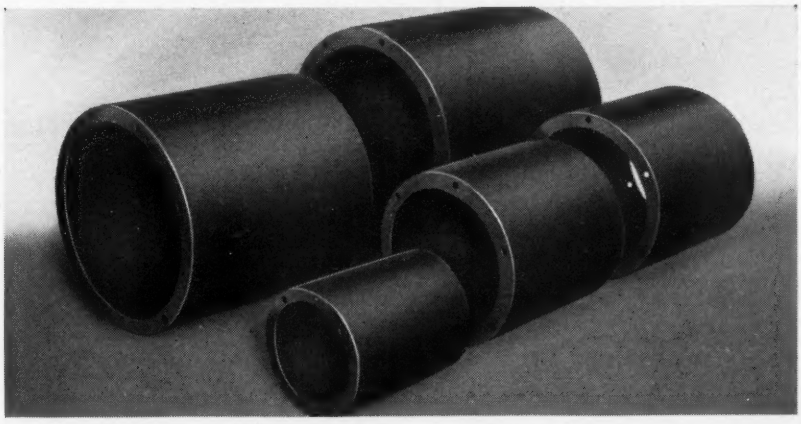

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Garrett, Indiana

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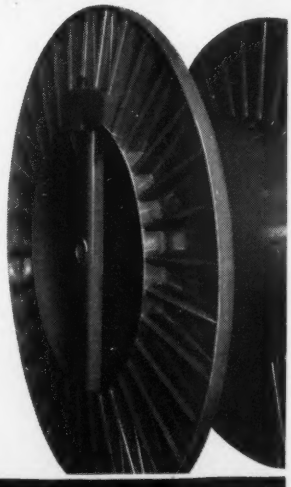
HUBBARD SPOOL COMPANY

to

manufacture under license arrangement with the Western Electric Co., Inc.

**Flanged Steel Drums or Traverses and Fluted-Type Steel Shipping Reels**



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### Chicago Convention
### The Wire Association

*(Continued from page 65)*

VAN VALKENBERG, F. S., Engr.,
Waterbury Farrel Fdry. & Mach. Co.,
Waterbury, Conn.

VAUGHN, L. A., President,
Vaughn Machinery Company,
Cuyahoga Falls, Ohio

VOIGTLANDER, CURTIS, Supt. Wire Mill,
Union Wire Rope Corp.,
Kansas City, Mo.

WALKER, S. E., Fact. Engr.,
Reynolds Wire Co.,
Dixon, Ill.

WARD, A. H., Devl. Engr.,
Carnegie Illinois Steel Corp.,
Pittsburgh, Penna.

WARD, C. T., Supt. Rod & Wire,
Bethlehem Steel Company,
Johnstown, Penna.

WATTS, L. A., Asst. Supt. of Wire Mills,
Wickwire Spencer Steel Co.,
Buffalo, New York

WEBER, ELMER C., Die Designer,
Firth-Sterling Steel Company,
McKeesport, Penna.

WEIGEL, A. A., Service Engr.,
Standard Industrial Compounds Co.,
Chicago, Illinois

WEIKEL, G. A., Repr.,
American Chemical Paint Co.,
Ambler Penna.

WEISEL, EARL,
Vaughn Machinery Co.,
Cuyahoga Falls, Ohio

WEISS, J. G., Foreman,
Keystone Steel & Wire Co.,
Peoria, Illinois

WELLINGS, CAPT. A. J., U.S.N.,
Office of Procurement & Material,
Navy Department,
Washington, D. C.

WEYANT, R. K., Plant Supt.,
Wilson Steel & Wire Co.,
Chicago, Illinois

WHITTAKER, STANLEY JAS., Mech. Engr.,
Canadian Elevator Equipment,
Toronto, Ont., Canada

WHITTEN, J. L., Vice Pres. & Sales Mgr.,
Lee Wilson Engineering Co.,
Cleveland, Ohio

WHYTE, R. B., Vice Pres. Oprs.,
Macwhyte Company,
Kenosha, Wisconsin

WIEL-QUILLARDET, L. A., Consultant,
Jersey Steel & Wire Corp.,
New York, N. Y.

WILKINSON, D. M., Asst. Che. Engr.,
Industrial Oven Engineering Co.,
Cleveland, Ohio

WILSON, W. L., Pur. Agt.,
North American Philips Co., Inc.,
Dobbs Ferry, New York

WINKLER, L. H., Met. Engr.,
Bethlehem Steel Company,
Bethlehem, Penna.

WOLF, RICHARD, Chief. Field Engr.,
Watson Machine Company,
Paterson, N. J.

WOODHEAD, R. R., Sales Mgr.,
John A. Manning Paper Co., Inc.,
Troy, New York

WOODWARD, C. J., Central Dist. Mgr.,
Rome Cable Corp.,
Chicago, Illinois

YOUNG, DUDLEY S., Dist. Engr.,
Anaconda Wire & Cable Co.,
Chicago, Illinois

ZARAFU, HERMAN, Chief Engr.,
Circle Wire & Cable Co.,
Maspeth, L. I., N. Y.

ZAPP, A. R., Mgr., Firthaloy Div.,
Firth-Sterling Steel Co.,
McKeesport, Penna.

ZENDER, RAYMOND G.,
Lenz Electric Mfg. Co.,
Chicago, Illinois

ZUCKER, LEONARD A., Gen. Mgr.,
Union Wire Die Corp.,
Stamford, Conn.

✦ ✦ ✦

## Brown Instrument Co. Applies for Patent on Thermocouple Design

A NEW type thermocouple, to be known as the "Carbu-couple", designed and constructed for cyanide carburizing in the heat treating and allied industries, is being introduced by The Brown Instrument Co., a division of Minneapolis-Honeywell Regulator Co. A patent has been applied for. It features a uniquely designed "hot" leg, consisting of an outer tube which has been heat-treated and surface conditioned by a special process, and an inner ceramic tube to protect thermocouple accuracy.

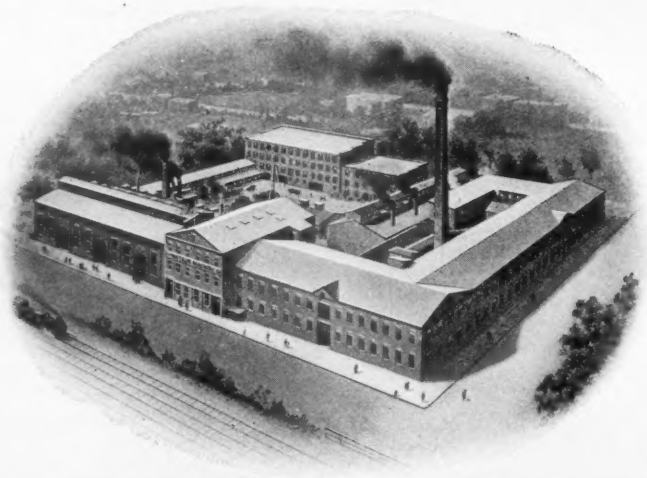
✦ ✦ ✦

CLAIMS made for the Carbu-couple include a lower base cost, greater durability and sensitivity and assured accuracy. Prompt delivery is also assured due to the use of non-critical materials in its construction. The instrument is said to have at least twice the life of thermocouples made with nickel tubes, and is more sensitive or responsive. The special inner tube protects the thermocouple element throughout the life of the tubes, overcoming the deterioration inherent in an unprotected couple.


THE WATSON MACHINE COMPANY
ESTABLISHED 1845
PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

Stranders
Bunchers
Cablers
Closers
Armor. Machines
Tapers
Juters
Serving Heads
Compound Tanks
Saturating Tanks
Powderers and Chalkers
Capstan Sections



Let-offs
Gang-Spoolers
Re-winders
Capstan Takeups
Continuous Takeups
Heavy-Duty Takeups
Traverses
Measuring Mach's.
Testing Mach's.
Vulcanizers
Polishers
Reel Crutches

MEAS. MACH'S., TRAVERSES, REEL CRUTCHES, BUNCHERS, SMALL POWDERERS, ETC. — USUALLY CARRIED IN STOCK

LITERATURE AVAILABLE ON ALL LISTED UNITS

## Efficiency Requirements in Purchasing

(*Continued from Page 54*)

reference. The principal items worthy of card-indexing are:-

a. **Suppliers Record which must contain names, addresses, dates of purchases, classes of goods, quantities and prices.**
b. **Commodity record which will be similar to (a) but indexed under 'goods' as opposed to 'names'.**
c. **Current Price Charts. Notwithstanding the controlling of many commodities—a control which will be gradually extended—there will continue to be price fluctuations, seasonal market prices and cycles. Only careful recording of such variations will permit at-a-glance appreciation of market currents and possibilities.**
d. **Delivery Record which will require daily attention in order to see firstly that reminders are sent to suppliers a few days previous to the promised delivery dates and secondly, in order to remonstrate without delay should any supplier fail to maintain and implement his earlier delivery promises.**

✦ ✦ ✦

## Specifications

CONSIDERATION should always be given to the possibility of obtaining tenders for standard goods on the basis of a specification circulated among the trade. Such a basis of purchasing offers opportunity for more advantageous acquisition and also serves the purpose of effecting new introductions which may, directly or indirectly, be of use to the Sales section.

✦ ✦ ✦

## Qualifications of a Buyer

WHILST a President may be born and not made the same claim cannot be advanced for the buying agent who, only after years of assiduous training and attention to his particular market can attain the peak of buying perfection. Many characteristics must feature in the make-up of the buyer. He must possess shrewd judgment, a full knowledge of the requirements of his principals, 100% appreciation of the products of his factory, an extensive appreciation of the possibilities of his own market and, above all, the highest possible standards of personal integrity. It is the buyer who is regularly able to turn to his particular advantage his particular benefit and therefore systems must be devised which will eliminate or have the effect of making such self-remuneration difficult of accomplishment.

## Pyrometer Accessory Manual

THE Bristol Company has recently published a new Pyrometer Accessory Manual, Number P1211, giving engineering data on the selection and installation of thermocouples, protection wells, and lead wire; thermocouple and protection well assemblies; and calibration data and tables.

OTHER information such as molten metal thermocouples, radiation couples, surface contact couples and special fittings and adopters is also included.

✦ ✦ ✦

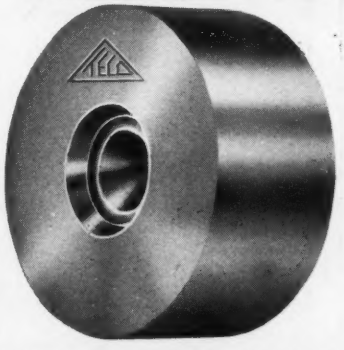
COPIES of this manual, Bulletin P1211 can be obtained from The Bristol Company, Waterbury 91, Connecticut.


THIS DIE
PAYS YOU
FOR
ITS OVER-TIME WORK

● Increased tonnage per die is the bonus you receive from the longer drawing life of TECO Cemented Carbide.

This long-run capacity is made possible by the rigid standards of density, hardness and uniformity to which TECO Cemented Carbide is held through every step in manufacture. TECO Cemented Carbide reduces wear and friction to a minimum. Holds accurate size and smooth finish for every pound of production.

Let a test run prove this in YOUR plant. Our engineers are glad to discuss your needs.



**WIRE and BAR DIES ● EXTRUDING DIES**
**TUBING DIES ● SIZING DIES**

Also Carbide Blanks, Tools, Bits, Reamers and Forming Tools.

**TUNGSTEN ELECTRIC CORPORATION, 564 39th Street, Union City, N. J.**
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio.
Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO — Pioneers in Tungsten Carbides for over a Quarter Century — CARBIDE DIES

### Why We Have Had to Curtail Copper for Domestic Uses

MODERN warfare consumes copper in quantities so vast as to be beyond the comprehension of the average individual.

✦ ✦ ✦

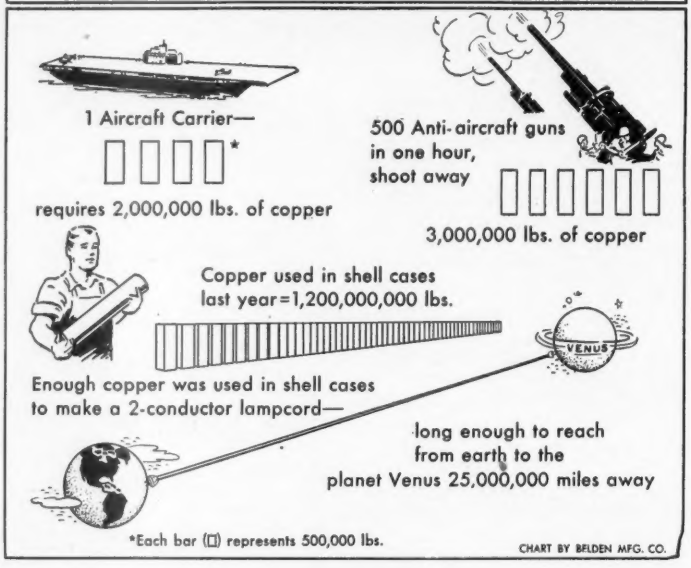
TO illustrate the vital role played by the metal, **H. W. Clough**, vice-president of the Belden Manufacturing Company, chose some data from only one branch of the combat services — the Navy — for the accompanying chart.

✦ ✦ ✦

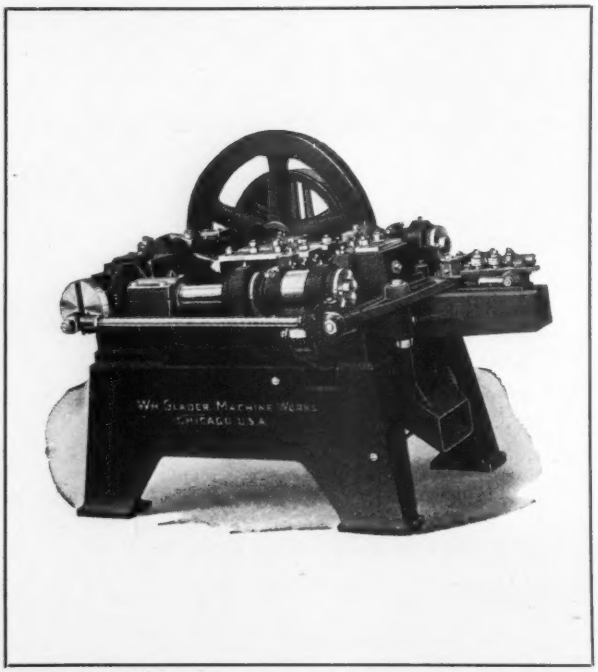
AN aircraft carrier requires upwards of 2,000,000 pounds of copper; a destroyer needs approximately 380,000 pounds; the small but deadly PT boats incorporate some 12,000 pounds; in one minute of combat 50 fighter planes shoot away 14,000 pounds of the metal; 500 of certain types of anti-aircraft guns discharge 3,000,000 pounds during one hour of operation. Last year approximately 1,800,000,000

## How Modern Warfare Consumes Copper

*Why we have had to curtail copper for domestic uses*


1 Aircraft Carrier—
requires 2,000,000 lbs. of copper
500 Anti-aircraft guns in one hour, shoot away
3,000,000 lbs. of copper
Copper used in shell cases last year=1,200,000,000 lbs.
Enough copper was used in shell cases to make a 2-conductor lampcord—
long enough to reach from earth to the planet Venus 25,000,000 miles away
VENUS
*Each bar (□) represents 500,000 lbs.
CHART BY BELDEN MFG. CO.


# GLADER HIGH SPEED WIRE NAIL MACHINE




High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS

210 NO. RACINE AVE.
CHICAGO, ILLINOIS

pounds of brass (containing approximately 1,200,000,000 pounds of copper) went into cartridge cases alone. This quantity of copper is sufficient for enough household lamp cords to reach to the planet Venus at its minimum distance from the earth — approximately 25,000,000 miles!

✦ ✦ ✦

VIRTUALLY every article of war, whether it is for direct combat use or equipment for industries producing for combat, requires copper in some form, Mr. Clough pointed out. Belden Manufacturing Company, with plants in Chicago and Richmond, Indiana, uses important quantities of copper for the production of electrical wires and cables in a large variety of applications for the fighting forces and war goods manufacture.

✦ ✦ ✦

## Outstanding Personalities of the Wire Industry

(*Continued from Page 55*)

### D. Ruotolo

IT is with regret that the passing of Mr. D. Ruotolo, Vice President of the Sirian Wire & Contact Company, Newark, N. J., is recorded. Mr. Ruotolo was well known to the wire industry as a manufacturer of carbide dies for drawing wire, tubing and eyelets.

✦ ✦ ✦

### Roebling Adds to Cleveland Branch

G. K. HAYES, who has represented the John A. Roebling's Sons Company, manufacturers of wire rope and wire, Trenton, New Jersey, as a salesman out of the company's Cleveland Branch for several years, has been appointed Assistant Manager of that branch.

✦ ✦ ✦

MR. HAYES is a graduate of the University of West Virginia and has been connected with the company since 1930.

✦ ✦ ✦

### duPont Appointment

THE appointment of **Frank Sanderson MacGregor** to be general manager of the Electrochemicals Department has been announced by E. I. duPont de Nemours and Company.

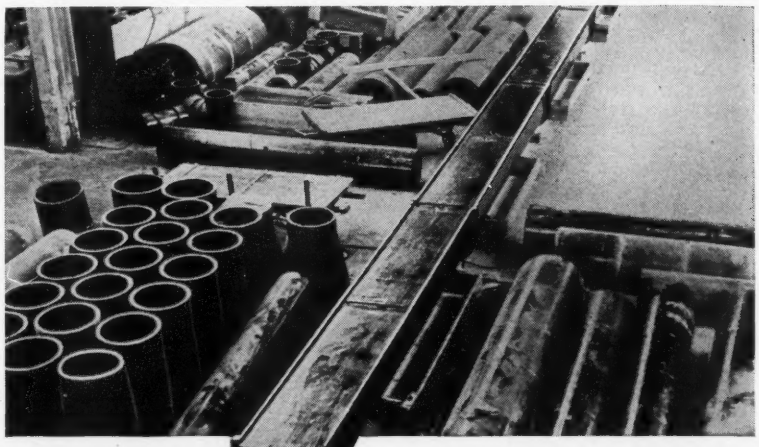
✦ ✦ ✦

THE appointment became effective January 1, 1944, when Mr. MacGregor, since February, 1942, assistant general manager of the department, will succeed **Dr. E. A. Rykenboer** who is retiring December 31 on account of ill health.

✦ ✦ ✦

### Floyd A. Day

FLOYD A. DAY, superintendent of the Johnstown, Pa., works of Bethlehem Steel Company, died recently in Pittsburgh.

**100 ft. of ACID Protection with Molded HAVEG**

**The above illustration shows a 100′ long sectional HAVEG continuous strip pickling tank—just before it left the HAVEG plant to take its place in an important WAR PRODUCTS plant.**

**HAVEG was selected for this job because it had proved itself unaffected by the acids commonly encountered in pickling processes.**

**HAVEG is unaffected by Muriatic Acid, any concentration—even at boiling; is unaffected by Sulphuric Acid up to 50% concentration, and a grade is available which is highly resistant to Hydrofluoric Acid.**

**HAVEG has strength, toughness and durability. It is unaffected by rapid temperature changes and can be used continuously at temperatures as high as 265°F.**

**Important to note is the fact that HAVEG *is not a lining* or *coating* but that its chemical resistance is constant throughout its entire mass.**

**HAVEG Equipment includes tanks, pipe, valves, fittings, fume duct, towers.**

***Bulletin F-3 gives complete technical, design and application data. Send for a copy today.***

***HAVEG-SARAN Tubing; Pipe & Fittings; and sheets are available from stock. HAVEG-SARAN is also described in Bulletin F-3. Send for a copy now.***

HM-43A

**HAVEG CORPORATION**
**NEWARK, DELAWARE**
**FACTORY—MARSHALLTON, DELAWARE**

CLEVELAND 550 Leader Building | CHICAGO 1201 Palmolive Building | DETROIT 2832 E. Grand Blvd. | LOS ANGELES 601 W. Fifth St.

# A Review of Recent Wire Patents

No. 2,333,158, STRAND HANDLING APPARATUS, patented November 2, 1943 by Archie J. Dowd, Plainfield, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

More specifically, a device is provided for supporting the unsevered end portion of a strand of wire after a section of the wire has been severed.

✦ ✦ ✦

No. 2,333,797, METHOD AND APPARATUS FOR MAKING SPIRAL SPRINGS, patented November 9, 1943 by Carl Kirchner, Carthage, Mo., assignor to Leggett and Platt Spring Bed and Manufacturing Company, Carthage, Mo., a corporation of Missouri.

The method consists in coiling wire to form a spiral spring with free end coils, depositing the coiled spring on its outer periphery at a location on a supporting pathway, causing the spring to travel forwardly without restraint supported on its periphery on the pathway from this location to a second location on the pathway, at the second location turning the spring on its axis by slipping frictional engagement therewith to bring the free end of one of the end coils against an abutment for positioning the end coil for knotting, and then knotting this positioned end coil.

**Complete Descriptions and Drawings of Patents May Be Had for 25 cents; outside United States and Canada, $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.**

No. 2,333,823, AUTOMATIC CUTOFF MECHANISM FOR RODS AND WIRE, patented November 9, 1943 by Charles J. Schliff, Waterbury, Conn., assignor to Chase Brass & Copper Co., Incorporated, Waterbury, Conn., a corporation.

An automatic cutoff mechanism is provided, adapted to sever the pieces with a minimum of distortion.

✦ ✦ ✦

No. 2,334,004, WIRE LOADER, patented November 9, 1943 by Carl Herzog, Belleville, N. J., assignor to Radio Corporation of America, a corporation of Delaware.

This apparatus straightens the wires, arranges them in a predetermined end-to-end position, and feeds them to a machine for further processing.

✦ ✦ ✦

No. 2,334,305, SPRING STRUCTURE, patented November 16, 1943 by Vito Asaro, Detroit, Mich., assignor to L. A. Young Spring and Wire Corporation, Detroit, Mich., a corporation of Michigan.

A back spring structure is provided, comprising wire coil springs, the border coils being retained in part, by paralleling wires and the others by cross springs. There are 14 claims.

✦ ✦ ✦

No. 2,334,406, ROOFING AND PACKING NAIL, patented November 16, 1943 by Arthur J. Gray, Detroit, Mich., assignor to Crescent Brass & Pin Company, Detroit, Mich., a corporation of Michigan.

Invention lies in the sheet metal head of this nail, provided with prongs paralleling the shank.

✦ ✦ ✦

No. 2,334,602, COIL WINDING MACHINE, patented November 16, 1943 by James S. Burge, Anderson, Ind., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware.

This machine comprises an arbor upon which are wound a plurality of coils each having layers of coil turns alternating with paper wrappings common to the coils, means for applying wrappings of paper to the arbor, means for cutting the paper wrappings between the end turns of adjacent coils, means for guiding wire in even layers upon the arbor, and a mechanism responsive to movement of the wire guiding means for causing the paper-wrapping-cutting-means to operate. There are 90 claims.


ROBINSON TUBE-TYPE WIRE STRANDERS

COMPLETELY REDESIGNED!

Sage engineering . . . Sound construction . . . and the knowledge gained through the exchange of ideas with customers . . . All are embodied in the advanced design and superior operation of the new improved Robinson Wire Strander. Full information available upon inquiry!

ROBINSON MANUFACTURING COMPANY
WORKS — MUNCY, PENNA.

*Sales Representatives*

MERCER-ROBINSON CO., INC., 30 CHURCH ST., NEW YORK

UNIQUE

No. 2,334,697, MANUFACTURE OF CONDUCTORS, patented November 23, 1943 by Henri Eichinger, Wilmington, Del.

✦ ✦ ✦

The last operation in the manufacture of the conductor, comprises a shaping operation during which the cable is elongated to an extent which does not exceed 5% of the elongation which the cable can undergo without rupture, whereby the dielectric strength of the insulating material of the resultant cable is at least 20% greater than would be the case if the last operation were an annealing treatment only.

✦ ✦ ✦

No. 2,334,699, ELECTROLYTE FOR THE POLISHING OF METAL SURFACES AND METHOD OF USE, patented November 23, 1943 by Charles L. Faust, Columbus, Ohio, assignor to Battelle Memorial Institute, Columbus, Ohio, a corporation of Ohio.

A solution for use in the anodic polishing of metals is provided and selected from the group consisting of iron and its alloys, nickel and its alloys and German silver, consisting essentially of from 5 to 85% of sulfuric acid and from 5 to 85% of ortho phosphoric acid, the combined acid content being at least 50% but not over 90% by weight of the solution and the balance being mainly water.

✦ ✦ ✦

No. 2,334,710, INSULATED ELECTRICAL CONDUCTOR, patented November 23, 1943 by Henry J. Kauth, Rome, N. Y., assignor to General Cable Corporation, New York, N. Y., a corporation of New Jersey.

About the wire conductor is a flexible non-inflammable, moisture-resistant jacket comprising a layer of inorganic fibres and a saturant of polymerized nitrogen halo phosphide for the layer, this saturant being infusible below 600° F. and remaining flexible under normal working temperature.

✦ ✦ ✦

No. 2,334,756, ELECTRIC CONDUCTOR, patented November 23, 1943 by Philippe Eugene Henri Eichinger, Clichy, France; vested in the Alien Property Custodian.

Powdered mineral insulation material is interposed between the conductor and sheath.

✦ ✦ ✦

No. 2,334,880, APPARATUS FOR WINDING CORES, patented November 23, 1943 by Douglas George Marlow, Altadena, Calif., assignor to National Technical Laboratories, South Pasadena, Calif., a corporation of California.

The core is moved longitudinally past the flexible member feeding device, the angle of feed being regulated within a desired range.

✦ ✦ ✦

No. 2,335,097, ELECTRICAL CONDUCTOR, patented November 23, 1943 by James N. Aken, Rome, N Y., assignor to General Cable Corporation, New York, N. Y., a corporation of New Jersey.

About the wire conductor is an asbestos insulation, saturated with a compound comprising chlorinated diphenyl and paraffin wax plasticized with a mixture of polyisobutylene of 10,000 to 20,000 molecular weight and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

No. 2,335,354, POLISHING STAINLESS IRON AND STEEL, patented November 30, 1943 by James N. Ostrofsky, Baltimore, Md., assignor to Rustless Iron and Steel Corporation, a corporation of Delaware.

Anodic treatment comprises immersing the metal to be polished in an aqueous bath consisting principally of an aliphatic-carboxylic acid, a soluble compound having a sulphate radical yielding a sulphate ion in the bath, and water in an amount less than approximately 50% by weight of the bath, and passing direct current through the bath using the metal as the anode, the current being of sufficient density to offset the gray etching action of the bath on the metal and to impart a polish thereto.

✦ ✦ ✦

No. 2,335,452, INHIBITOR FOR ACID PICKLING BATHS AND PROCESS OF MAKING, patented November 30, 1943 by Franz Schelling, Dornholzhausen in Taunus, Germany; vested in the Alien Property Custodian.

The inhibitor consists of at least one substance selected from the group consisting of ammonium thiocyanate and thiourea the crystals of which are coated superficially with a condensation produce of paraformaldehyde and aniline.

✦ ✦ ✦

No. 2,335,707, THERMOCOUPLE WIRE, patented November 30, 1943 by Johann S. Streicher, Newark, N. J., assignor to The American Platinum Works, Newark, N. J., a corporation of New Jersey.

This wire comprises an alloy of platinum and gold, wherein the gold content does not exceed approximately 5%.


SPENCER *OFFERS*

- Superior finishes.
- Improved quality in fine sizes of Bethanized wire.
- Elimination of tensile drop due to heat consumed in hot dip practice.
- Positive coatings of uniform thickness.
- Free of impurities, lumps and discoloration.
- Produced in all sizes from .001 to .025.

SPENCER WIRE COMPANY

West Brookfield Plant

WEST BROOKFIELD, MASS.

PRECISION MANUFACTURERS OF HIGH AND LOW CARBON STEEL AND ALLOY WIRES

# DIAMOND WIRE DRAWING DIES

Fort Wayne Wire Die Co., is housed in a new and up-to-date plant with every modern facility for producing dies under working conditions that make for quality. Although larger quarters were built last year, we have had to expand further to keep pace with the demands for more of these excellent dies.

***The name "Fort Wayne" stands for the finest in quality and craftsmanship. Our customers can expect courteous and co-operative service on every order, and we strive to make each die so well that it will merit your good-will.***

Range of Sizes: .0006" to .102"

You are invited to consult us on your diamond die problems. Please address inquiries to:

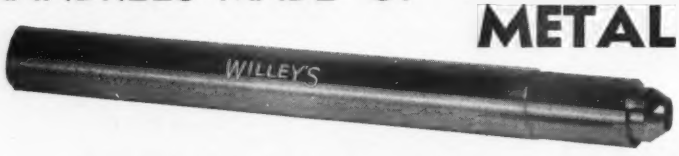
**FORT WAYNE WIRE DIE COMPANY**

**2625 EAST PONTIAC STREET • FORT WAYNE, INDIANA**

**Telephone: Harrison 4319**

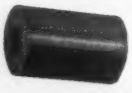


# MANDRELS MADE OF WILLEY'S METAL




Designed especially to meet production requirements on all types of tubing.

Mandrels made of WILLEY'S METAL insure long life and a fine finish on any type of steel, brass, copper and other alloys. Can be furnished in all standard sizes as well as to your specifications.



Many of our customers prefer to purchase nibs made of WILLEY'S METAL rough formed and do their own finishing. These can be furnished in standard sizes or to your specifications on short notice.

WRITE FOR QUOTATION ON PARTICULAR SIZES REQUIRED.

SALES ENGINEERS IN ALL PRINCIPAL CITIES

**WILLEY'S CARBIDE TOOL CO.**

*SOLE MAKERS OF WILLEY'S METAL*

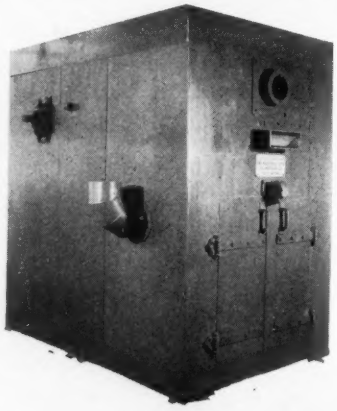
1342 W. Vernor Highway Detroit 1, Michigan


## New Oven for Batch Heating

THE Industrial Oven Engineering Company, 11621 Detroit Avenue, Cleveland, is now producing a standard box-type oven in several standard sizes for a variety of batch heating purposes. It uses any commercial oven fuel including electricity. Door sizes range from 3 feet wide by 5 feet high to 5 feet wide by 7 feet high, with working depths from 4 to 10 feet.

✦ ✦ ✦

HEATING equipment is built into the oven shell, and the oven is shipped assembled, ready to operate except for the attachment of accessories. Ductwork is likewise built in, and is arranged for cross flow and vertical air passage, affording positive and rapid circulation through a relatively dense work load. Recirculation and exhaust ducts are arranged to prevent belching or leaking at the door opening.



ONE of the principal features of the series illustrated here is close temperature tolerance within limits from 200 to 1000° F. On high-temperature units, inside panels are made of steel plates with heat affected parts of chrome and chrome-nickel alloys. Ovens can be furnished with or without positive exhaust fan systems, depending on the processes for which they are to be used.

✦ ✦ ✦

STANDARD temperature controls are expansion recording thermometer type or millivolt-

meter type, depending on accuracy of control required. Full electric safety equipment protects the system against flame, current or air failure.

✦ ✦ ✦

THESE ovens can be used with trucks or racks for steel strip dehydrogenizing, aluminum heat treating, stress relieving of N.E. alloys, metal finishing, curing of synthetic resins, tempering and blueing of steel parts, and a number of other miscellaneous applications.

✦ ✦ ✦

## Standards Policy Committee Appointed At G.E.

A GENERAL Electric Company Standards Policy Committee, headed by **L. F. Adams,** Manager of the Standards Division, has been appointed by **W. R. Burrows,** vice-president in charge of general manufacturing matters, and **R. C. Muir,** vice-president in charge of general engineering matters. The Committee will be responsible for the development and maintenance of sound design engineering and manufacturing standards and practices for use throughout the Company.

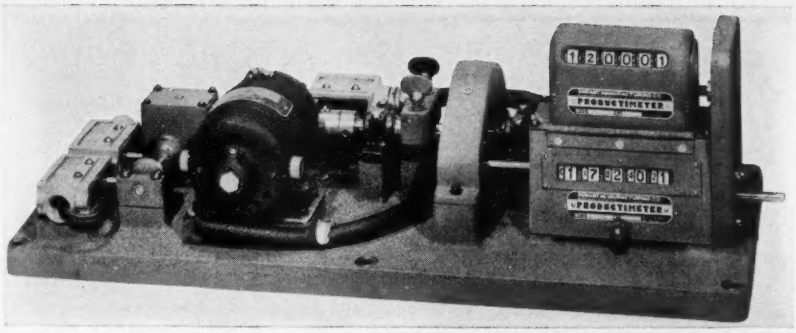
✦ ✦ ✦

## New Production Honors for Phelps Dodge

THE Navy Board of Production Awards has honored the Habirshaw (Yonkers, N. Y.) Division of the Phelps Dodge Copper Products Corporation with a second renewal of the Army-Navy "E" award.

✦ ✦ ✦

THE new pennant, in addition to the "E", carries two stars indicative of two renewals of the original award. It has been forwarded by the Navy Department and will fly over the Yonkers plant at an early date. At Los Angeles another Phelps Dodge Copper Products Corporation plant was honored by the Maritime Commission, with the presentation of the Maritime M.

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**THIS NEW MOTOR RESET PRODUCTIMETER**

for Cable Insulating Machines, measures predetermined lengths to be wound on reels—then, in less than 4 seconds, is automatically reset to the original setting. During resetting, small limit switches energize electric circuits that

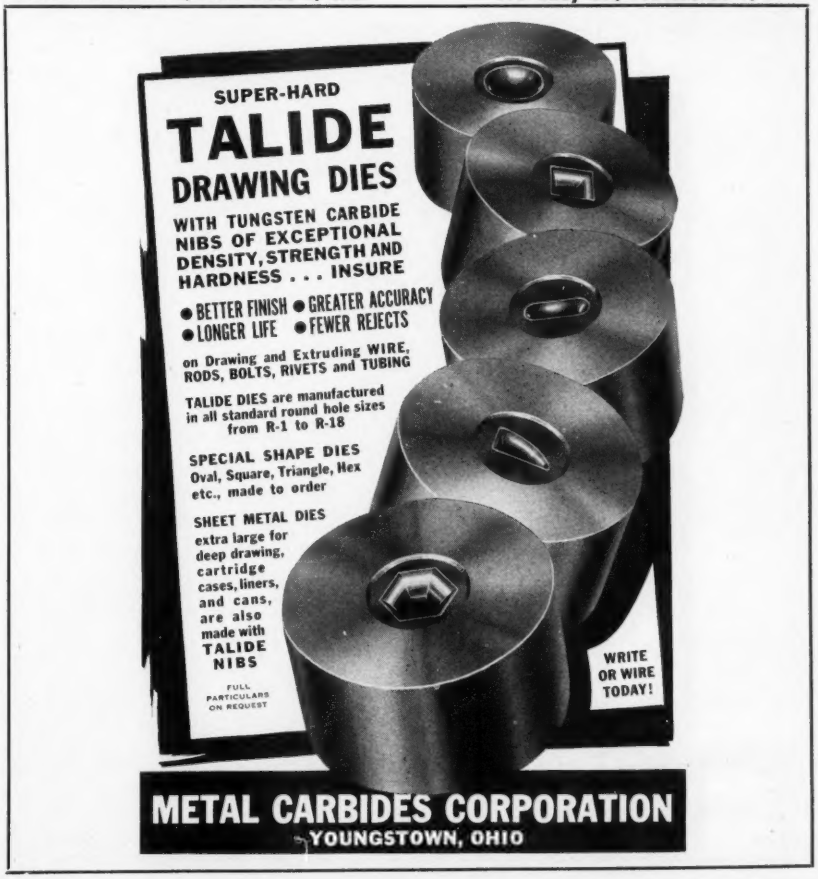
- control operation of flying shears for cutting the cable
- lead severed ends into waiting reel
- forward or reverse traverse mechanism
- light signal lamps indicating the traverse mechanism engaged, and the circuit which energizes counter resetting motor

This is one of many wire measuring units designed by Durant. There is one to meet your particular needs. Submit your problem for our recommendation.

***Bulletin No. 3 sent at your request.***

**DURANT MANUFACTURING COMPANY**

**1918 N. Buffum St., Milwaukee 1, Wis.** **176 Eddy St., Providence 3, R. I.**


SUPER-HARD
TALIDE
DRAWING DIES
WITH TUNGSTEN CARBIDE NIBS OF EXCEPTIONAL DENSITY, STRENGTH AND HARDNESS . . . INSURE
● BETTER FINISH ● GREATER ACCURACY
● LONGER LIFE ● FEWER REJECTS
on Drawing and Extruding WIRE, RODS, BOLTS, RIVETS and TUBING
TALIDE DIES are manufactured in all standard round hole sizes from R-1 to R-18
SPECIAL SHAPE DIES
Oval, Square, Triangle, Hex etc., made to order
SHEET METAL DIES
extra large for deep drawing, cartridge cases, liners, and cans, are also made with TALIDE NIBS
FULL PARTICULARS ON REQUEST
WRITE OR WIRE TODAY!
METAL CARBIDES CORPORATION
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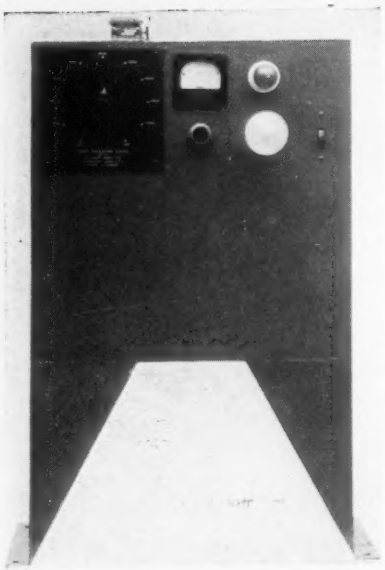
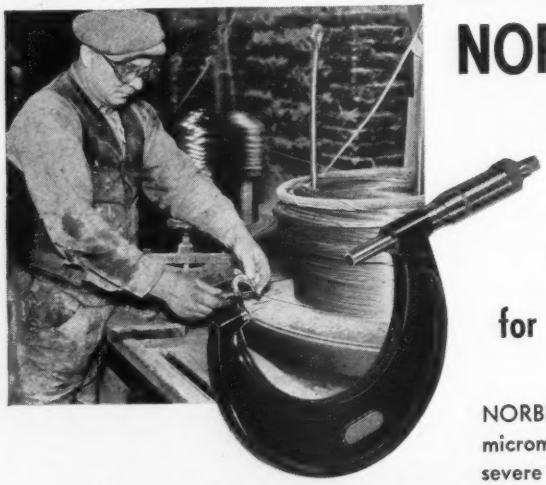
## SPARKER for SYNTHETIC EXTRUSION COMPOUNDS



THIS APPARATUS WILL LOCATE DIELECTRIC FAULTS while the wire is being insulated. When breakdown occurs, the operator is notified by an audible alarm. A resettable counter gives the number of faults in each reel. By sorting out the defective reels in this operation, the majority of the resparking is eliminated. Continuous range of voltage at the electrode is from one thousand to sixteen thousand volts. The sparker is equipped with voltmeter reading in kilovolts, and automatic interlock with the takeup motor.

**R. L. Davis Electric Co.**

Wallingford, Conn.



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to gages used

**for "Miking" Wire**

NORBIDE contact points on micrometers will withstand severe and continuous usage in production work and always give remarkably long service. NORBIDE tips will outwear conventional micrometer tips many times, particularly where there is abrasive action as in gaging wire. NORBIDE is the trade name for Norton Boron Carbide, the hardest commercially-produced material.

N-62

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**NORBIDE** *ABRASIVE AND MOLDED PRODUCTS*


### Signal Corps Troops in Italy

WITH the Fifth Army in Italy—Communications, like rations, are one thing the artillery, engineers and doughboys depend on at all times, particularly in a landing operation.

✦ ✦ ✦

AND communications those troops had when they invaded the Salerno Sector on "D" Day, September 9, 1943, when virtually every type of troops in the Fifth Army hit the sand. This wasn't all happenstance. It came about through careful planning by the Signal Corps.

✦ ✦ ✦

COMMUNICATIONS with ships in the harbor—command ships, rather than the conventional well-grounded Army command posts—were established at almost the precise moment the first troops set foot ashore, and although maintenance of these lines was rugged at times, there were few instances where the troops ashore were out of instant contact either with their sister platoons, companies, battalion or regimental headquarters or the higher echelons of command.

✦ ✦ ✦

THE work of the Signal Corps was inspiring, and in order to furnish the high command with the necessary verbal picture these men frequently got out ahead of the combat troops.

✦ ✦ ✦

IN Italy, one Signal company actually got ahead of the Infantry, with the result that the information they phoned back to the heavy guns of the destroyers, cruisers, and other craft in the harbor offshore brought about the destruction of German Mark VI tanks which threatened the whole landing party.

✦ ✦ ✦

DURING the early operations most of the equipment had to be brought ashore in "ducks" which frequently shipped water in the high seas.

✦ ✦ ✦

DURING the height of the operations the divisional signal

company lost one jeep when it came into contact with a mine. The battery of another went dead, thus cutting down the mobility of the signalmen, but nevertheless they went ahead, sometimes on their bellies, stringing wire and getting switchboards and other apparatus into operation.

✦ ✦ ✦

WHEN darkness settled on "D" Day and the division was fairly well established on shore, an inspection disclosed that contact had not only been maintained with the front line units, but also with those on each side of the division. When the first day ashore came to an end, the company found that it had established four switchboards over which was operated a net of telephones. In addition, it had installed six telegraph sets, laid one-half mile of field wire, and three miles of assault wire.

✦ ✦ ✦

ON the assault phase of the operation, some 200 tons of signal equipment was brought ashore by the Fifth Army and its respective units. However, where they had hoped to salvage some of the wire that was left behind by the Germans, they were disappointed, for the enemy had not only cut the wire but had carried away whole sections so as to make any salvaging operations extremely difficult. Not only did Jerry carry away the wire, but to make things even more difficult, he cut down poles, while at the base of others he planted booby traps and land mines to catch the careless soldier.

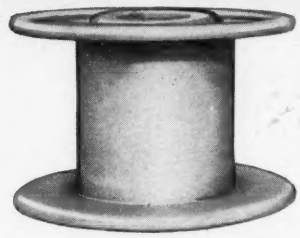
✦ ✦ ✦

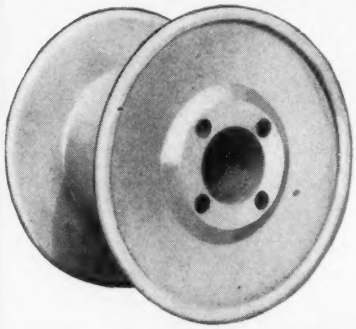
IN the first 10 days of the operation in Italy, 400 miles of fixed wire was laid in addition to 300 miles of assault wire.

**AD THOUGHT**

**A magazine's editorial content and its ADVERTISING supplement each other. Each, in its way, informs readers of the time-tried and the new. Read both. Keep abreast of what's happening in your field. And as advertising revenues make possible editorial service PLEASE let advertisers know that you have seen their ads in WIRE & WIRE PRODUCTS.**


**FOR HIGHEST SPEEDS**





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Higher and more uniform physical and fatigue properties.

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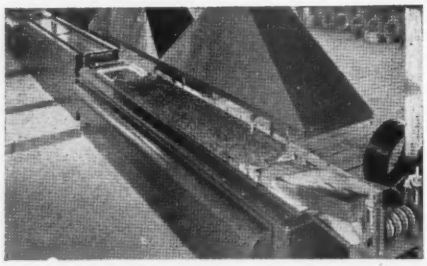

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# APEX "PIC-KLEEN" PERFORMANCE DATA

(Case #45)

*Type of Wire:* Low Carbon.

*Speed:* 1500 ft. /min.

*Reduction:* From .080 to .0317 or 84%.

*No. of Holes:* 6

*Drawn:* Dry.

*Tensile Strength:* 120,000.

*Results:* The heretofore necessary use of lime was completely eliminated, the finish on the wire being materially improved.

*Conclusion:* Valuable time was saved through the elimination of the liming operation, in addition to the time saved by eliminating the oven-baking step.

APEX "PIC KLEEN" COATING COMPOUND can do for you in your Mill, just what it has already done in many other Wire Mills, and on most types of wire. A trial will convince you.

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## How to Find the Open Area of Wire Screen or Wire Cloth

By W. F. Schaphorst, Newark, N. J.

WIRE screen, sometimes known as wire cloth, is being used more and more in connection with machinery—for protection, screening, filtering, — for keeping out dust, dirt, and foreign objects that may prove harmful—and so on.

✦ ✦ ✦

IN general, the greater the "open area" of the wire screen the better. More air can get through to keep motors cool where the screen is used for protection. More material can get through where the screen is used for sifting. Thus, if, for example, the projected area of the metal in the wire screen is one-half of the total area, the "open area" will also be one-half, or 50 per cent because 1 minus 50% equals 50%.

✦ ✦ ✦

THE rule of formula that is generally used for finding the open area of wire screen is regarded by some as being cumbersome, because it goes at the problem "backwards." It gives the closed area, and then we are told to subtract that area from 1. The answer will be correct, of course, but the method is clumsy. The following rule gives the open area directly:

**A—Multiply the number of wires in the warp per inch by the diameter of the warp wires in inches and subtract the product from 1. Call the answer "A".**

**B—Multiply the number of wires in the shoot per inch by the diameter of the shoot wires in inches and subtract the product from 1. Call the answer "B".**

**C—Multiply "A" by "B" and the product is the open area.**

✦ ✦ ✦

FOR example, what is the open area of a wire screen having 6 warp wires per inch and 6 shoot wires per inch, the diameter of all wires being 0.025 in.?

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SUBSTITUTING in the above rule we have this:

**A—6 x 0.025 equals 0.15. Subtracting 0.15 from 1 we have 0.85.**

**B—Since the shoot and warp wires are the same we get the same result for "B" as for "A", namely, 0.85.**

**C—0.85 X 0.85 equals 0.7225.**

✦ ✦ ✦

THE "answer" therefore is 0.7225, which means that the open area of this particular wire screen is 72¼ per cent.

✦ ✦ ✦

FOR those who prefer formulas to rules, the formula is:

**Open area = (1 — ND) (1 — nd)**
**where N = number of wires in the warp per inch;**
**n = number of wires in the shoot per inch;**
**D = diameter of wires in the warp, inches;**
**d = diameter of wires in the shoot, inches.**

✦ ✦ ✦

## Army-Navy "E" Award to Yale & Towne

THE Army-Navy "E" flag flies over the plant of another well-known manufacturer, the Philadelphia Division of the Yale & Towne Manufacturing Company. This producer of materials handling machinery can be proud of this citation for production excellence. All branches of the armed forces use their hand and electric hoists — hand lift and electric trucks to speed the lifting and transporting of goods and war materials in plants, warehouses, depots, aboard ship and on the field.

✦ ✦ ✦

THESE same handling tools are helping thousands of industrial plants speed production of their own vital war goods, many of them, too, have earned the Army-Navy "E". The great demands of all plants for Yale material handling machinery caused them to expand and expand production facilities and to produce hoists and trucks.


This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues are $10.00

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300 Main St., Stamford, Conn.
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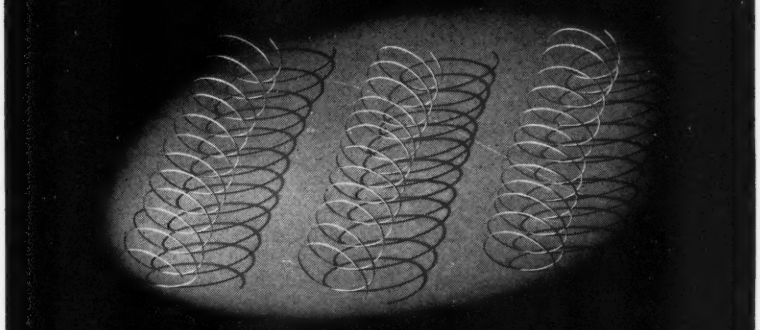

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***These coating compounds are of particular value in the more difficult operations—stainless, alloy, high carbon and welding rod wire. Multiple reductions can be drawn without re-coating.***

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The coating is applied as a dip-coat after pickling, and the draw is carried on from this point without the use of lime. Coating is good for five to six holes at low or high speed on single hole benches. On continuous machines, it is being used at from 7 to 12 holes at speeds up to 2,000 feet per minute.

On stainless steel wire on one hole draws up to 120 feet per minute, the coating alone is sufficient. At higher speeds and on multiple hole drawing, the wire is limed on top of the coat.

Magnus Coating Compound is easier to handle and clean to use. The more uniform and adherent coat results in better drawing and improved work surface. Considerable economy is realized, not only because of better production, but because die life is lengthened.

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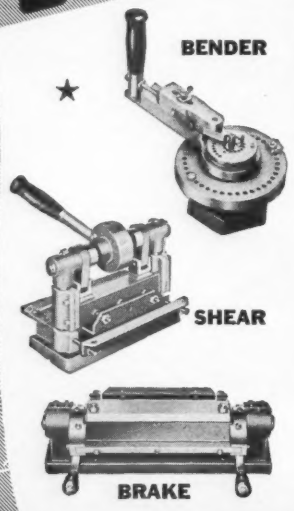

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## Paper On Salt Bath Hardening of Taps and Dies

PAUL C. FARREN, Chief Metallurgist of the Greenfield Tap and Die Corporation, recently prepared a paper entitled "Hardening High Speed Taps and Dies in the Electric Salt Bath."

✦ ✦ ✦

REPRINTS of this article are available, and if desired, may be secured by writing to the Ajax Metal Company, Inc., Frankford Ave. at Delaware Ave., Philadelphia, 23, Pa. This paper is a thorough analysis of all types of practice, and in the words of the author, "All evidence indicates that it would be possible to select almost any average person and teach him the successful procedure for toolsteels within a week."

✦ ✦ ✦

THE paper covers handling technique, straightening and tempering, furnace operation and maintenance, metallurgical inspection, and a chapter on general observations, and is a practical treatise on the use of salt baths.

✦ ✦ ✦

## Post-War Homes Will Need Modernized Wiring

HOME wiring systems must be modernized and greatly expanded to keep pace with an anticipated sharp increase in electric appliance use after the war, according to **Irving W. Clark**, manager of the Better Homes Department of the Westinghouse Electric and Manufacturing Company. He believes that national home consumption of electric power likely would at least double its present average in the post-war era, which will call for expanded and intelligently planned wiring to handle this increased power demand. Mr. Clark says the post-war home will be an electrical home. Few pre-war homes have wiring requirements to carry the loads imposed by pre-war electric appliances. A large percentage of older homes require extensive wiring additions to even meet the 1941 average appliance use efficiently.

# STEEL WIRE

By MAURICE BONZEL

✦ ✦ ✦

Translated and Published by

**Kenneth B. Lewis**

Consulting Engineer

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495 pages—414 illustrations

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Typical of other responses is that from Dr. Zay Jeffries, General Electric authority, who says: "The book constitutes a valuable addition to the literature of metallurgy".

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## WPB Issues Order On Diamond Dies M-181, Nov. 16, 1943 (As Amended)

THE fulfillment of requirements for the defense of the United States has created a shortage in the supply of diamond dies for defense, for private account, and for export; and the following order is deemed necessary and appropriate in the public interest and to promote the national defense:

[1] **General Conservation Order M-181-(a) Definitions.** For the purposes of this order:

(1) "Diamond die" means any diamond which has a hole through it and which is designed for use in the drawing of wire.

(2) "Small diamond die" means a diamond die with a hole of a diameter of 0.0015 inch or smaller.

(3) "Supplier" means any person who engages in the importation, processing, or sale of diamond dies, or any person, other than a consumer, who owns or has possession of one or more diamond dies.

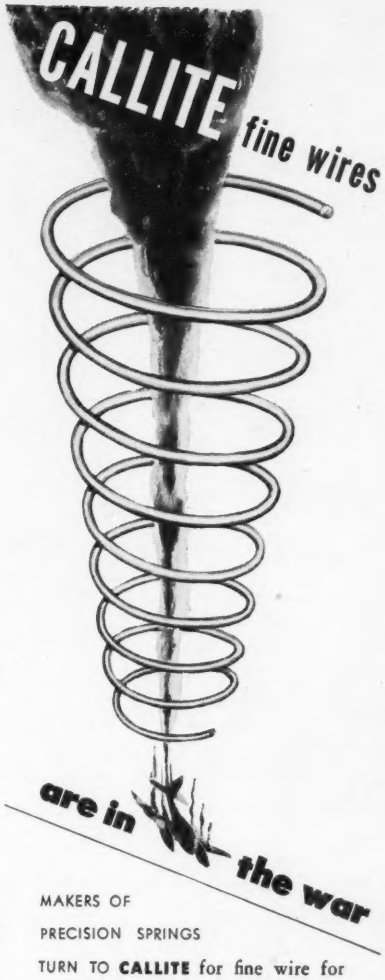
(4) "Processing" means drilling, piercing, and polishing a diamond for use as a diamond die.

(5) "Consumer" means any person who uses a diamond die for the purpose of drawing wire.

(b) **Restrictions on suppliers of small diamond dies—(1) Reserve.** Each supplier is hereby directed to set aside his entire stock of small diamond dies, including stocks received after July 1, 1942 from any source, as a reserve for the fulfillment of present and future defense orders, and such other orders and uses as may be authorized from time to time by the War Production Board.

(2) **Allocations.** No supplier shall make deliveries or withdrawals from such reserve either to fill orders received from customers or for purposes of his own processing or use except as authorized or directed by the War Production Board. The War Production Board will from time to time allocate the supply of small diamond dies and may specifically direct: the persons to whom deliveries shall be made and from whom deliveries

(*Please turn to Page 80*)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**CALLITE WIRE** is always uniform, accurate in diameter, drawn to the optimum properties of the metal or alloy specified, and finished exactly right for their purpose. Our engineers are at your service. Callite Tungsten Corporation, 572 Thirty-ninth Street, Union City, New Jersey.

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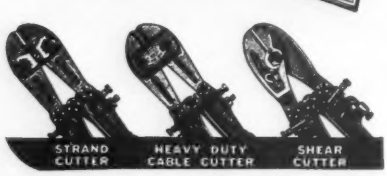


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## WPB Issues Order On Diamond Dies M-181, Nov. 16, 1943 (As Amended)

(*Continued from Page 79*)

shall be received; the manner, amounts, and times of such deliveries; the persons who may process, and the manner, amounts, sizes, and times of processing; and the particular uses which may or may not be made. Such allocations and directions will be made to insure the satisfaction of the defense requirements of the United States, both direct and indirect, and they may be made in the discretion of the War Production Board without regard to any preference ratings assigned to particular contracts or purchase orders.

(c) **Restrictions on consumers.** Unless specifically directed or authorized by the War Production Board, no consumer after July 1, 1942, shall sell or deliver any small diamond dies to any other person, except Defense Supplies Corporation, or any other Federal agency organized pursuant to section 5 (d) of the Reconstruction Finance Corporation Act, as amended.

(d) **Reports — (1) Supplier.** Each supplier shall file Form WPB-1228 (formerly PD-559) with the War Production Board, Ref: M-181, on or before the 20th day of each calendar month.

(2) **Consumer.** Each consumer who uses or possesses one or more small diamond dies shall file Form WPB-1229 (formerly PD-560) with the War Production Board, Ref: M-181, on or before the 20th day of each calendar month. Each consumer who uses and possesses only diamond dies with holes having diameters larger than 0.0015 inch shall file Form WPB-1229 with the War Production Board, Ref: M-181, on or before January 20, 1944, giving the information therein required for the calendar year 1943, and on or before the 20th day of January of each year thereafter, giving the information therein required for the preceding calendar year.

**Brighter Wire**

**One of 4 Advantages!**

MANY wire manufacturers have benefited by one or more of these four IMPORTANT advantages by introducing specialized Oakite materials in their wire pickling and cleaning operations:

1. **BRIGHTER WIRE**
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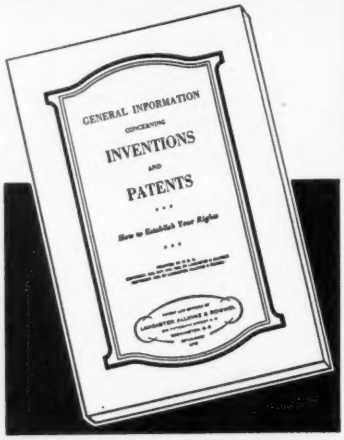


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**Registered Patent & Trade-Mark Attorneys**
**438 Bowen Bldg., Washington, D. C.**

(3) **Other reports.** All persons affected by this order shall file such other reports as may be required from time to time by the War Production Board, subject to the approval of the Bureau of the Budget, pursuant to the Federal Reports Act of 1942.

(4) **Federal Reports Act of 1942.** The reporting requirements of this order have received the approval of the Bureau of the Budget pursuant to the Federal Reports Act of 1942.

(e) **Miscellaneous provisions.** (1) **Applicability of regulations.** This order and all transactions affected hereby are subject to all applicable provisions of War Production Board regulations as amended from time to time.

(2) **Communications to War Production Board.** All reports required to be filed hereunder, and all communications concerning this order, shall. unless otherwise directed, be addressed to: War Production Board, Miscellaneous Minerals Division, Washington 25, D. C. Ref: M-181.

(3) **Violations.** Any person who willfully violates any provision of this order, or who in connection with this order, willfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime, and upon conviction may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining further deliveries of, or from processing or using, material under priority control and may be deprived of priorities assistance.

Issued this 16th day of November, 1943.

War Production Board,
By J. Joseph Whelan,
Recording Secretary.

[1] **Formerly Part 1289, § 1289.1.**

*Illustration Shows Exclusive Patented "3V" Principle*

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PROVIDES NEW STANDARD OF ACCURACY

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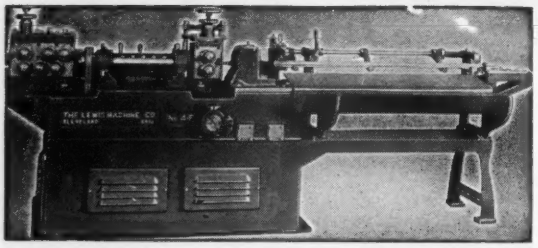

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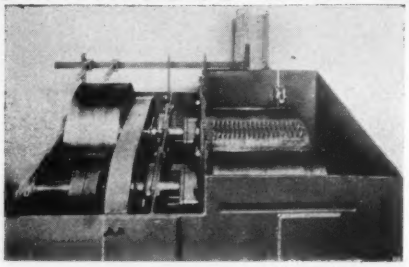

for low carbon, high carbon and alloy wires, with provision for twenty drafts. Spooling attachment furnished if desired.

Also makers of other wire drawing machines, wire mill accessories, such as spoolers, straighteners, pointers and water cooled die holders, and special machinery.

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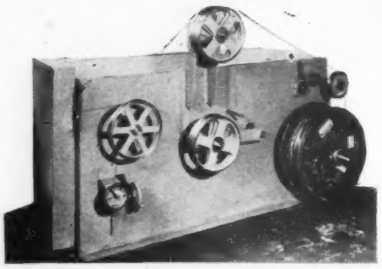

**A compact Take-up for Wire, Synthetic Cords, etc., for use in connection with Extrusion Machine, or process operations, etc.**

Reel Speed synchronized hydraulically, Constant Speed Capstan and Adjustable Constant Tension with Adjustable Traverse, Welded Frame, Ball-Bearing throughout and built-in Motor Drive.

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**NIAGARA Aero HEAT EXCHANGER**

Saves cooling water cost, saves equipment, saves power. Controls temperature of Wire Drawing Compounds, Industrial Liquids, Quenching Baths, Jacket Water, Lubricating Oils.

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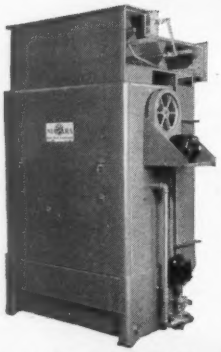

U. S. Patent Nos. 2,296,946 and 2,321,933


## The Navy and the Wire Industry

(*Continued from Page 36*)

and I may say that in most cases no words can fully describe them. Here at home, no matter how bad conditions are they are relatively comfortable compared with the ones under which our fighting men live and fight.

✦ ✦ ✦

IF our Navy men were all here today they would have two requests to make of you:

**One: Give us good quality material.**
**Two: Give us more material, at least 10% more.**

✦ ✦ ✦

WE will check your answers to these requests by keeping account of the quality and quantity of material you turn out for the Navy.

✦ ✦ ✦

## Firthite Color Charts Available

THE Firth-Sterling Steel Company, McKeesport, Pa., recently announced their newly-developed system of "color-branding" as a ready means of telling one grade of sintered carbide from another.

✦ ✦ ✦

IN addition to the wall charts previously announced, they have made these available in a small size for insertion in engineers manuals, data books, etc.

✦ ✦ ✦

EITHER the data sheet or wall chart sizes of this chart will be sent on request.

✦ ✦ ✦

## New Literature

AJAX Electric Company, Inc., Frankford Ave. at Delaware Ave., Philadelphia, 23, Pa., has prepared a new four-page folder called Heat Treatment, that illustrates and describes briefly a variety of salt bath furnaces, including those applicable to wire annealing, cyaniding, high speed steels, neutral hardening, aluminum alloys, carburizing, tempering, isothermal heat treatment, armor plates and armor piercing shot. This folder or Catalog 107-A, giving the full engineering story, are available on request. Write to Dept. W.

## Cellulose Acetate Butyrate As A Primary Insulation for Wire and Cables

(*Continued from Page 39*)

THIS paper would not be complete without some reference to the mechanical aspects of applying tape to wire. In this connection, the most significant property of Acetate Butyrate or LEXEL is its elongation factor of about 40%. This, of course, implies careful slitting and packaging. Every pad or package of this tape is checked before shipping and no stock is passed which does not elongate 40% without breaking.

✦ ✦ ✦

VARIOUS types of equipment are in use, some of which take pads or pancake packages, while others require universally wound packages. The pads are, of course, less expensive and it is our considered opinion that all manufacturers would do well to convert to that type of equipment. Much equipment now in use can be classed as "home-made" and therefore we have the temerity to suggest certain changes or alterations when requested which most certainly can lead to increased production. Our Mr. Betts is here today and will be glad to be of service to any of you who may care to discuss your mechanical problems with him.

✦ ✦ ✦

AS a matter of academic interest, I am going to ask **Mr. Harold Crouch** of the Technical Staff of the Eastman Kodak Company to say a few words on the material "Cellulose Acetate Butyrate" per se — after Mr. Crouch's remarks, we will be only too happy to answer any questions which may be presented by you gentlemen.


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All types of wire redrawn to specifications

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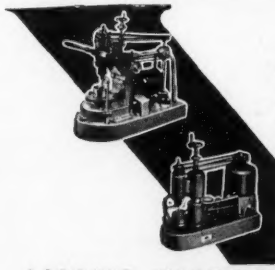

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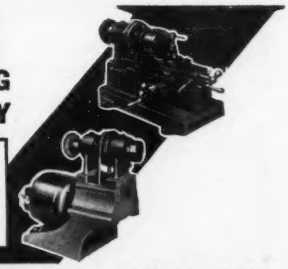
Has proven itself by the performance of precision and quality work in almost every steel, aluminum and copper mill in the U.S.A.



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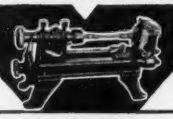

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## "Settling Plant Grievances"

THE U. S. Department of Labor has published a 48-page booklet entitled "Settling Plant Grievances" that has been favorably received by a number of industrial relations executives. This booklet includes a chapter on co-operation, in which a grievance is defined and illustrated from both labor and management's viewpoints. Other chapters describe the mechanics of grievance procedure and how to make grievance procedure work.

✦ ✦ ✦

EMPLOYERS of labor should find this very helpful, and if interested, may secure copies by writing the Division of Labor Standards, U. S. Dept. of Labor, Washington 25, D. C.

## New Booklets Issued On Heat Treating Operations

### New Literature

SURFACE Combustion, Toledo, Ohio, has issued six new booklets covering different heat-treating operations, which they will be glad to send upon request to persons in the wire industry. The titles of these pamphlets are:

**Annealing and Normalizing in SC Furnaces.**
**SC Batch Type Gas Carburizing Furnaces.**
**Modern Malleableizing in SC Furnaces.**
**SC Draw Furnaces.**
**SC Hardening Furnaces.**
**Light Metals Heating and Heat Treating in SC Furnaces.**

✦ ✦ ✦

EACH of these is fully illustrated with pictures of the equipment details of construction, charts and tables of operating data to provide a quick and readily understood grasp of what the furnaces can do.

**ORDER YOUR COPY NOW—LIMITED EDITION**

**Diamond and Gem Stone Industrial Production**

**PAUL GRODZINSKI**

**PRICE $5.00**

**The use of diamonds and gem stones as dies for fine wire drawing, and of diamonds for cutting tools, is comparatively recent. Today it is extensive and increasing. In this book the author has brought together all the data and information available on the subject and has added the results of his own experience and research. Although dealing mainly with the actual production of the dies and tools, the knowledge this book imparts is of prime importance to tool users. Efficiency and economy in the use of diamond and gem stone dies and tools is not possible without a knowledge of production methods.**

✦ ✦ ✦

**There are reference tables and a large number of specially drawn illustrations included in this book. An endeavor has been made to leave no phase of the subject untouched.**

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## Youngstown Welding and Engineering Issues New Catalog

THE Youngstown Welding and Engineering Company Youngstown, Ohio, has an interesting, new 16-page catalog. It shows many photographs of a wide variety of welded steel crates, baskets, chains, and accessories which are used in connection with pickling, enameling, and heat treating operations.

✦ ✦ ✦

THE purpose of the catalog is not only to show the wide variety of equipment that is available, but to also give the readers many pictures from which they may get good, new production ideas. Anyone may receive one of these catalogs promptly by writing to the company.

✦ ✦ ✦

## Cored Wire Drawing Dies

TO assist mills producing fine wire, etc., Carboloy Co., Inc., 11171 E. 8 Mile Road, Detroit, has announced the availability of round hole cored dies in stock sizes as small as 0.004 to 0.007 in. The smaller cored die sizes eliminate the necessity for either an initially higher die investment or of piercing blank dies to produce diameters of wire down to 0.010 in. They are available with standard size R-2 Carboloy nibs and casing sizes either 1 or 1½ x 9/16 in.


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## "Iridite"

RHEEM Research Products, Inc., a subsidiary of Rheem Manufacturing Company, 2523 Pennsylvania Ave., Baltimore 17, Md., has developed a new material called "Iridite," which may be applied to plated surfaces using zinc or cadmium that is said to provide almost complete protection against the corrosion of these coatings. It has been tried on and is being used on various wire and screen cloth parts with success, greatly prolonging the useful life of these items. Several other concerns are testing the material with a view to improving the products to be offered in the post-war markets.

✦ ✦ ✦

A DESCRIPTION of Iridite is contained in a four-page folder and a separate sheet covers operating data on its use. Please address inquiries to the company if interested in investigating this product.

✦ ✦ ✦

## John S. Richards

JOHN S. Richards, director of research of the American Steel & Wire Company, died December 23rd. He started working for the National Tube Company as a chemist at the National Works in McKeesport, Pa., in November, 1912. In September of the following year, he was transferred to the Edgar Thomson Works of the Carnegie Steel Company as assistant chief chemist which post he held until being made head chemist at the Donora (Pa.) Steel Works of the American Steel & Wire Company in September, 1928. In October, 1934, Mr. Richards moved to Cleveland as a metallurgist in the main offices. He was manager of the metallurgical division from April, 1937, to March, 1942, when he was appointed director of research of the company.

✦ ✦ ✦

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COIL LOADING and STRIPPING MACHINES — WIRE SPIDERS
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6—Lewis Welding Wire S. & C. Machines M. D.
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Washington, Penna.

## Material Handling Equipment Catalog

THE Yale & Towne Manufacturing Company, Philadelphia 24, Penna., has published a 120-page catalog on material handling equipment that not only describes the various kinds of trucks and hoists made by them, but treats of the problems of handling materials from a practical, functional standpoint. From this point of view the book contains layouts illustrating the efficient flow of materials from receiving, through production and on to shipping. Many of the illustrations show the proper use of pallets, and methods of storing different materials in warehouses. If a copy of this is wanted, write to the Company, Dept. W., asking for their catalog "Modern Material Handling Machinery."

✦ ✦ ✦

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MECHANICAL ENGINEER wanted, who is experienced in design of wire mill machinery and wire insulating equipment, to work in engineering and drafting office of manufacturer of electrical conductors located in New York State. Release or statement of availability necessary. Apply Box #364, c/o
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# WHERE TO BUY

**For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.**

**ABRASIVES—**
Norton Co., Worcester, Mass.

**ACID INHIBITORS—**
American Chemical Paint Co., Ambler, Pa.

**ACID PROOF CONSTRUCTION—**
Ceilcote Co., The, Cleveland, Ohio

**AIR DRAW FURNACES—**
Carl-Mayer Corp., The, Cleveland, Ohio.

**ALKALINE CLEANERS—**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

**ANNEALING MACHINES—Open Flame**
Syncro Machine Co., Rahway, N. J.

**ANNEALING POTS AND BOXES—**
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

**ARMORING EQUIPMENT—**
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**BAKERS—Flash**
Morrison Engr. Corp., Cleveland, Ohio

**BAKERS—Hi-Speed**
Carl-Mayer Corp., The, Cleveland, Ohio.

**BAKERS—Rod and Wire**
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

**BENDERS—**
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

**BOBBINS—Braider and Wire Weaving**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**BORON CARBIDE—**
Norton Co., Worcester, Mass.

**BRAKES & SHEARS—**
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

**BRICKS—Acid Proof**
Keagler Brick Co., Steubenville, Ohio.

**CABLE LACQUERING OVENS**
Industrial Oven Engr. Co., Cleveland, Ohio.

**CABLE—Steel and Copper**
Brewer Mfg. Co., Muncy, Pa.

**CARRIERS—Braider, High Speed**
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.

**CASTINGS—Wire Mill**
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

**CEMENTS—Acid Proof**
Sauereisen Cement Co., Pittsburgh, Pa.

**CEMENTS—Refractory**
Norton Co., Worcester, Mass.

**CHEMICALS—Cleaning**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

**CLEANERS—Hand and Metal**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**CLEANING & PICKLING EQUIPMENT—**
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Haveg Corporation, Newark, Del.
Morgan Construction Co., Worcester, Mass.
Nukem Products Corp., Buffalo, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**CLOTH TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**CLOTH—Wire, All Metals**
Callite Tungsten Corp., Union City, N. J.

**COATING COMPOUNDS—**
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**COILERS—Sheet, Strip and Wire**
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

**COLD HEADERS—**
Ajax Manufacturing Co., Cleveland, Ohio
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**COMPOUNDS—Coppering**
American Chemical Paint Co., Ambler, Pa.

**COMPOUNDS—Metal Finishing**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

**COMPOUNDS—Rust Preventing**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

**COMPOUNDS—Rust Removing**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

**COMPOUNDS—Wire Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**CONTROLS—Heat Treating**
Niagara Blower Co., Buffalo, N. Y.

**CONTROLS—Temperature**
Niagara Blower Co., Buffalo, N. Y.

**COPHOLDERS—Steel**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**CRANES—Wire Mill**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**CUTTING TOOLS—Carbide**
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

**CUTTING TOOLS—Wire**
Porter, H. K., Inc., Everett, Mass.

**DIAMONDS—Industrial**
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Callite Tungsten Corp., Union City, N. J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Wks., New York, N. Y.

**DIAMOND POWDERS—**
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.

**DIAMOND TOOLS—**
Rusch Wire Die Corp., New York, N. Y.

**DIE MAKING MACHINERY — For Forming Special Shapes**
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

**DIES—Diamond**
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

**DIES—Lead Extrusion**
Robertson, John, Co., Brooklyn, N. Y.

**DIES—Repairs & Re-Cutting**
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

**DIES—Rod and Tube Drawing**
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

**DIES—Tantalum Carbide**
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

**DIES—Tungsten Carbide**
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.
Wopis Industry Laboratory, Brooklyn, N. Y.

**DIRECT ELECTRIC RESISTANCE—Heating**
Trauwood Engr. Company, Cleveland, Ohio

**DRAW BENCHES—**
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

**DRUMS—Flange Steel**
Stevens Metal Products Co., Niles, O.

**DRUMS—Vulcanizing**
Mossberg Pressed Steel Corp., Attleboro, Mass.

**DRYING EQUIPMENT—**
Niagara Blower Co., Buffalo, N. Y.
Ross, J. O., Engr. Corp., New York, N. Y.

**ENGINEERS—Consulting Wire Mill**
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

**EQUIPMENT—Humidifying**
Niagara Blower Co., Buffalo, N. Y.

**EQUIPMENT—Industrial Cooling**
Niagara Blower Co., Buffalo, N. Y.

**EQUIPMENT—Insulation Testing**
Davis, R. L., Electric Co., Wallingford, Conn.

**EYELETS—Brass or Zinc**
Platt Bros. & Co., The, Waterbury, Conn.

**FLASH BAKER—**
Morrison Engr. Corp., Cleveland, Ohio

**FLUXES—Soldering**
American Chemical Paint Co., Ambler, Pa.

**FOAM PRODUCING COMPOUNDS—**
American Chemical Paint Co., Ambler, Pa.

**FURNACES—Annealing**
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

# WHERE TO BUY, Continued

**FURNACES—Automatic**
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**FURNACES—Brazing**
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

**FURNACES—Bright Annealing**
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**FURNACES—Electric**
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engr. Co., Cleveland Ohio

**FURNACES—Hardening & Tempering**
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engr. Co., Cleveland Ohio

**FURNACES—Lead Melting**
Electric Furnace Co., Salem, Ohio
Robertson, John, Co., Brooklyn, N. Y.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

**FURNACES—Non-Oxidizing**
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

**FURNACES—Normalizing**
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

**FURNACES—Pot (Oil, Gas and Electric)**
Holden, A. F., Co., New Haven, Conn.

**FURNACES—Salt Bath**
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

**FURNACES—Wire, Strip & Sheet**
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**GALVANIZING EQUIPMENT—**
Meaker Co., The, Chicago, Ill.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**GALVANIZING KETTLES—**
National Annealing Box Co., Washington, Penna.

**GRINDERS—Roll**
Norton Co., Worcester, Mass.

**HI-SPEED BAKERS—**
Carl-Mayer Corp., The, Cleveland, Ohio

**HOISTS—Electric Travelling**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

**INHIBITORS—**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

**KETTLES—Galvanizing, Annealing, Tinning, etc.**
National Annealing Box Co., Washington, Penna.

**LATHES—Die Reaming**
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

**LININGS—Acid and Alkali Proof**
Ceilcote Co., The, Cleveland, Ohio

**LUBRICANTS—For Metal Cutting, Stamping and Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**LUBRICANTS—Wire Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**MACHINERY—Armoring (Cable, Wire Hose)**
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Braiding**
Fidelity Machine Co., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Brazing**
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Bunching**
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Bundling, Scrap**
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Cable, Electric**
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Chain Making**
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

**MACHINERY—Closing**
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Coil Winding**
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Coilers**
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Cold Heading With Wire Drawing Attachment**
Ajax Manufacturing Co., The, Cleveland, O.

**MACHINERY—Copper Wire Drawing and Rolling**
American Insulating Machy. Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Covering Wire**
American Insulating Machy. Co., Philadelphia, Pa.
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Cutting**
Ajax Manufacturing Co., The, Cleveland, O.
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Inc., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Robinson Mfg. Co., Muncy, Pa.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Die Making**
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.

**MACHINERY — Die Making for Forming Special Shapes**
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

**MACHINERY—Draw Benches**
Ajax Manufacturing Co., The, Cleveland, O.
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

**MACHINERY—Edging**
Broden Construction Co., Cleveland, Ohio.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Enameling**
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Extruding**
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Flat Wire**
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Forming**
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Galvanizing**
Wilson, Lee, Engr. Co., Cleveland, Ohio

**MACHINERY—Galvanizing Wire**
Broden Construction Co., Cleveland, O.
Meaker, Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

**MACHINERY—Gang Winders**
Fidelity Machine Co., Philadelphia, Pa.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Grinding**
Norton Co., Worcester, Mass.

**MACHINERY—Insulating**
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Knitting**
Fidelity Machine Co., Philadelphia, Pa.

**MACHINERY—Lead Encasing Presses, etc.**
Robertson, John, Co., Brooklyn, N. Y.

**MACHINERY—Lead Stripping**
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Lock Washer**
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Magnet Wire**
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

# WHERE TO BUY, Continued

**MACHINERY—Material Handling**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

**MACHINERY — Measuring Wire & Cable**
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Nail and Tack**
Broden Construction Co., Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Panning**
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Pointing**
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Quill Winding**
Fidelity Machine Co., Philadelphia, Pa.

**MACHINERY—Rod Mill**
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

**MACHINERY—Rolling Mill**
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Rubber for Insulating Wire**
Royle, John, & Sons, Paterson, N. J.

**MACHINERY—Rubber Strip Covering**
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Rubber Tubing and Straining**
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Screw Wire**
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Special**
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Spooling**
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
Marshall Richards Machine Co., Ltd., Gainsborough, England.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Spring Making**
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Staple**
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Straightening**
Ajax Manufacturing Co., Cleveland, Ohio
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Mfg. Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Stranding**
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Strip Steel**
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Swaging**
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Taping**
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Testing**
Robinson Mfg. Co., Muncy, Pa.
Scott, Henry L., Co., Providence, R. I.

**MACHINERY—Testing Size of Wire**
Davis, R. L., Electric Co., Wallingford, Conn.

**MACHINERY—Testing Spring**
Standard Machinery Co., Providence, R. I.

**MACHINERY—Tinsel Rolling Mills**
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Trolley Wire**
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

**MACHINERY—Tube Mill**
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

**MACHINERY—Welding Wire**
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Winding**
American Insulating Mach'y Co., Phila., Pa
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Wire Bending**
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

**MACHINERY—Wire Drawing**
Ajax Manufacturing Co., Cleveland, Ohio
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

**MACHINERY—Wire Measuring**
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Wire Rope**
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Wire Tinning**
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

**MACHINERY—Wood Screw**
National Machinery Exchange (Used), New York, N. Y.

**MATERIAL HANDLING EQUIPMENT**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

**MILLS—Tandem Rolling and Edging**
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

**NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip**
Hudson Wire Co., Ossining, N. Y.

**OILS—Wire Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**OVENS—Cable Lacquering**
Industrial Oven Engr. Co., Cleveland, Ohio

**OVENS—Industrial**
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Oven Engr. Co., Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

**PAINTS—Heat Resisting**
American Chemical Paint Co., Ambler, Pa.

**PAINTS—Marine**
American Chemical Paint Co., Ambler, Pa.

**PAINTS—Structural Steel**
American Chemical Paint Co., Ambler, Pa.

**PANS—Lead and Spelter**
National Annealing Box Co., Washington, Penna.

**PANS—Vulcanizing**
Mossberg Pressed Steel Corp., Attleboro, Mass.

**PAPER—Creped Wrapping**
Crepe-Kraft Co., Newark, N. J.

**PAPER TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**PATENT ATTORNEYS—**
Lancaster, Allwine and Rommel, Washington, D. C.

**PATENT INFORMATION SERVICE—**
Manufacturers World Patent Information Service, Brooklyn, N. Y.

**PICKLING COMPOUNDS—**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

**PICKLING TANK LININGS—**
Keagler Brick Co., Steubenville, Ohio.
Sauereisen Cement Co., Pittsburgh, Pa.

**PIPES AND FITTINGS—Acid Resistant**
Haveg Corp., Newark, Del.

**PLASTIC TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**POTS—Lead Melting**
Robertson, John, Co., Brooklyn, N. Y.

**POWDER—Wire Drawing**
Apex Alkali Products Co., Philadelphia, Pa.

# WHERE TO BUY, Continued

**PRESSES—Hydraulic and Mechanical**
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

**PRESSES—Lead**
Robertson, John, Co., Brooklyn, N. Y.

**PRESSURE VESSELS—**
National Annealing Box Co., Washington, Penna.

**PULLERS—Wire**
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

**PUMPS—Hydraulic**
Robertson, John, Co., Brooklyn, N. Y.

**QUENCHING BATH CONTROLS—**
Niagara Blower Co., Buffalo, N. Y.

**REEL AND TENSION STAND—**
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery Co., Cleveland, Ohio
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

**REEL CRUTCHES—**
Watson Machine Co., Paterson, N. J.

**REELS—Annealing and Stranding**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**REELS—Steel**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**REELS AND SPOOLS—Shipping and Shop**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**REELS—Takeoff**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**REELS—Vulcanizing and Impregnating**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**REELS—Wire Drawing**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**REFRACTORIES—High Temperature**
Norton Co., Worcester, Mass.

**ROD BAKERS—**
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Engr. Corp., Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

**RODS—Wire—Non-Ferrous**
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

**RODS—Wire—Steel**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Spencer Steel Co., New York, N. Y.

**ROLL STRAIGHTENERS—**
Moslo Machinery Co., Cleveland, Ohio

**ROPE—Wire**
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

**RUBBER AND RUBBER COMPRESSION TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**RUST PROOF COMPOUNDS—**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

**RUST REMOVING COMPOUNDS—**
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

**SHEARS—**
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

**SHEET—Steel**
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

**SOAPS—Industrial and Wire Drawing**
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

**SPOOLS—Annealing and Wire Drawing**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**SPOOLS—Shipping and Shop**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**SPOOLS—Steel**
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

**STAMPINGS—Steel**
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

**STRAND—Steel and Copper**
Brewer Mfg. Co., Muncy, Pa.

**STRIP—Brass and Non-Ferrous**
Hudson Wire Co., Ossining, N. Y.

**STRIP—Steel**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio

**STRIP METAL TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**SWIFTS—Take-off**
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**TANK LININGS—Brick**
Keegler Brick Co., Steubenville, Ohio.
Nukem Products Corp., Buffalo, N. Y.

**TANKS—Compound**
Watson Machine Co., Paterson, N. J.

**TANKS—Pickling**
Haveg Corp., Newark, Del.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

**TANKS—Steel**
Mossberg Pressed Steel Corp., Attleboro, Mass.

**TEMPERATURE CONTROLS—**
Niagara Blower Co., Buffalo, N. Y.

**TENSILE TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**TESTING INSTRUMENTS—**
Scott, Henry L., Co., Providence, R. I.

**TOOLS—Wire Cutting**
Porter, H. K., Inc., Everett, Mass.

**TRAMRAIL SYSTEMS—**
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

**TREADS—Safety**
Norton Co., Worcester, Mass.

**TRUCKS—**
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**TUBE BENDERS AND FORMERS—**
Ruesch, H. J., Machine Co., Newark, N. J.

**TURKS HEADS—Friction and Power Driven**
Standard Machinery Co., Providence, R. I.

**VALVES AND FITTINGS—Acid Resistant**
Haveg Corp., Newark, Del.

**VULCANIZERS—**
Watson Machine Co., Paterson, N. J.

**VULCANIZING PANS—**
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**WELDERS—Spot and Butt**
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio

**WIRE—Beryllium Copper**
Little Falls Alloys, Inc., Paterson, N. J.

**WIRE—Cold Heading**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

**WIRE—Electric**
American Brass Co., Waterbury, Conn.
Callite Tungsten Corp., Union, City, N. J.
Hudson Wire Co., Ossining, N. Y.
Seneca Wire & Mfg. Co., Fostoria, Ohio

**WIRE—Enameled for Coils**
Winsted Div. of Hudson Wire Co., Winsted, Conn.

**WIRE—Manufacturers**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Spencer Wire Co., W. Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.

**WIRE—Music**
American Brass Co., Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Jersey Steel & Wire Corp., Irvington, N. J.
Johnson Steel & Wire Co., Worcester, Mass.
Seneca Wire & Mfg. Co., Fostoria, Ohio

**WIRE—Nickel Silver and Phosphor Bronze**
American Brass Co., Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

**WIRE—Non-Ferrous to Specification for Special Purposes**
American Brass Co., Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

**WIRE—Spring**
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., Fostoria, Ohio

**WIRE—Stainless Steel**
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Spencer Wire Co., W. Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.

**WIRE—Steel—Also Coppered Steel—Also Galvanized Steel**
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Spencer Wire Co., W. Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.

**WIRE AND STRIP—Zinc**
Platt Bros. & Co., The, Waterbury, Conn.

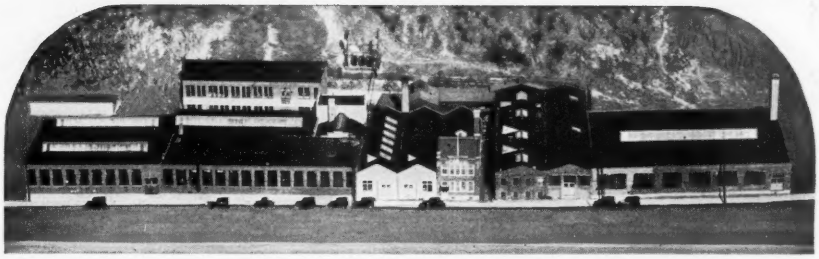
**WIRE TESTERS—**
Scott, Henry L., Co., Providence, R. I.

**WIRE, WEAVING—Non-Ferrous**
American Brass Co., Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

**WRAPPING PAPER—Creped**
Crepe-Kraft Co., Newark, N. J.

**YARN TESTERS—**
Scott, Henry L., Co., Providence, R. I.

# HUDCO



HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

This plant is one of the most up-to-date and completely equipped plants in the world for the production of "HUDCO" fine wires in all metals.

ESTABLISHED IN 1902

**HUDCO**

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire. Cadmium, Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze, Brush Wires, Crimp and Straight, Brass, Steel, Nickel Silver, Copper and Phosphor Bronze.

**HUDCO**

FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper. Cadmium, Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

*BETTER WIRE AT LOWER COST*

*Send Us Your Specifications and Let Us Quote Prices*

HUDSON WIRE COMPANY • OSSINING, N. Y.

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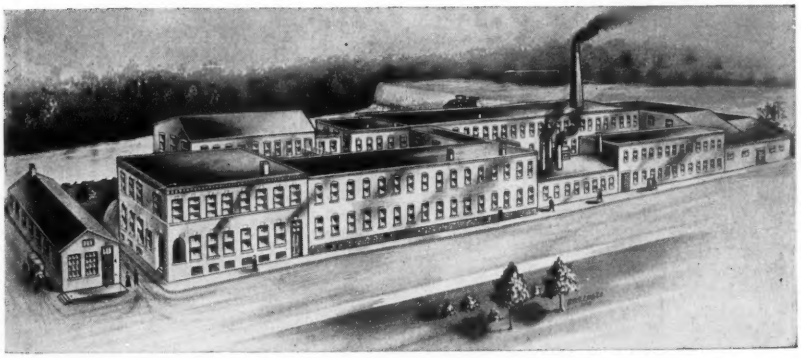


Winsted Division of HUDSON WIRE CO. at Winsted, Conn., modern and completely equipped enamelled wire plant for LEAKPROOF ENAMELLED WIRE and all standard and special coverings.

# WINCO

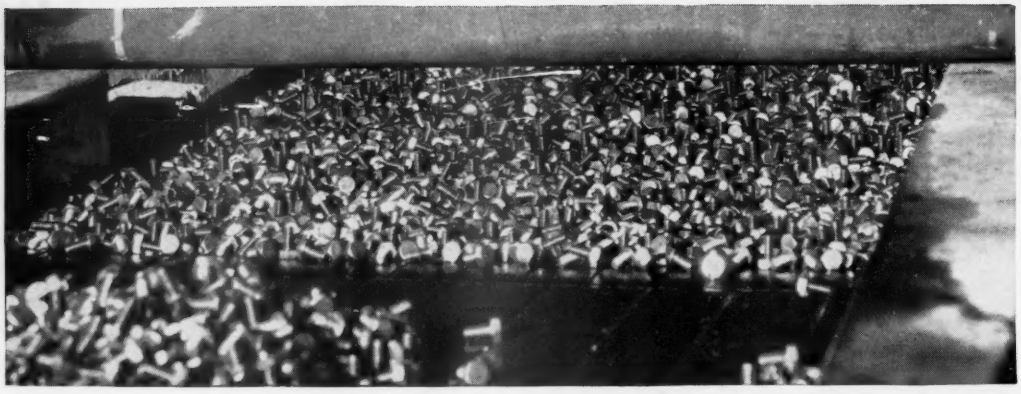
"WINCO" enamelled wire is drawn from special selected copper, assuring perfect enamelling. All wire tested before shipment.

"WINCO" enamelled wire is available in all standard and special coverings made to meet exacting requirements.

*Samples of LEAKPROOF and other enamelled wires sent on request*

WINSTED DIVISION OF HUDSON WIRE COMPANY

WINSTED, CONN.



Charging end of an EF continuous chain belt conveyor furnace hardening small cap screws.

# Bolts, Nuts, Cap Screws, etc.

## Uniformly Hard, Tough and with Clean Sharp Threads

## are discharged continuously from EF scale-free hardening furnaces

**In addition to machine screw products, many other small and medium size parts such as springs, pinions, gears, bearing parts, and other products are being treated uniformly and continuously in these chain belt furnaces.**

Material is loaded directly onto the conveyor belt; either manually or by automatic feed. Without further attention, it is carried through the furnace, uniformly heated in a protective atmosphere and automatically discharged to the quenching medium without coming in contact with air. The belt returns within the furnace without cooling—no pans or trays are used—100% net material.

These furnaces may be oil fired, gas fired, or electrically heated. We build them in five standard sizes with capacities ranging from 300 to 1700 pounds per hour. Larger or smaller sizes can also be furnished if required. Any size can be designed for using the special protective atmosphere for scale free heat treating or hardening without decarburization.

The Chain Belt Conveyor Furnace is only one of the numerous types of production furnaces we build. Other recent installations include furnaces for bright annealing both ferrous and non-ferrous strip, wire, tubing and other products . . . furnaces for the production heat treatment of tank armor castings, cartridge cases, shell forgings, bomb and gun parts, machine gun cartridge clips, aircraft and aircraft engine parts, aluminum and magnesium castings, and many other products.

## The Electric Furnace Co., Salem, Ohio

**Gas Fired, Oil Fired and Electric Furnaces—For Any Process, Product or Production**

**Send for circulars showing EF Chain Belt Furnaces and other types of EF Production Furnaces**